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A MANUAL

OF

YACHT AND BOAT SAILING.

BY

DIXON KEMP,
A.I.N.A.

(AUTHOR OF "YACHT DESIGNING.")

LONDON:
"THE FIELD" OFFICE, 346, STRAND, W.C.

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PREFACE.

In launching the "Manual of Yacht and Boat Sailing," I desire to acknowledge the valuable aid which I received during its compilation. Mr. J. Beavor Webb compiled the tables for rigging and blocks, and gave me the lines of the Itchen Boats; Mr. G. L. Watson, of Sauchiehall-street, Glasgow, made the drawings of Clyde Sailing Boats, and wrote the chapter thereon; Mr. C. P. Clayton gave me the lines of the New Brighton Sailing Boats, and much information concerning their outfit and management; and he, too, with Mr. W. B. Forwood, gave me the instruction I required concerning Windermere Yachts; Mr. W. Baden Powell gave me the drawing and particulars of the Gunter Sprit Rig introduced by him; Mr. T. Stow, yacht builder, of Shoreham, gave me the lines of the Brighton Beach Boat; and Mr. J. R. Wills, of Penzance, the design of the Penzance Lugger. Some of the information on other subjects I obtained from correspondents of The Field, and I believe the source is in each case acknowledged in the text.

DIXON KEMP.

104, Palace Gardens Terrace,
Kensington, London, W.,
June 1, 1878.

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ERRATA.

Page 38, at commencement of paragraph, *for* "The stability of stiffness of a yacht, &c.," *read* "The stability *or* stiffness, &c."

In the same paragraph, three lines lower down, *for* "angle of keel, ' *read* "angle of heel. '

Page 39, fifth line from the top, *for* "66 per cent.," *read* "50 per cent."

Page 68, fifth line from the bottom, *for* "further delay," *read* "further outlay."

Page 100, in the footnote, fifth paragraph from the bottom, *for* "multiplied by the fraction," *read* "multiplied by the fraction 0·2545."

Page 139, ninth line from the bottom, *for* "1 ton 6 cwt. (1·4 ton)," *read* "1 ton 6 cwt. (1·3 ton)."

Page 142, second line from the bottom, *for* "let go the mizen sheet or reverse the helm," *read* "let go the mizen sheet *and* reverse the helm."

Page 260, eighth line from top, *for* "vessel and her manner," *read* "vessel and her manner of ballasting."

YACHT AND BOAT SAILING.

INTRODUCTION.

The Art of Yacht and Boat Sailing cannot be acquired by the mere study of books which treat of the subject, but precise instruction will always be of value to those who have had no early experience of the sport, or who were not "to the manner born." Yacht sailing, like many other arts, is governed by certain scientific principles, easily determinable in theory, although hidden in practice. Experience has taught every sailing master that, if a vessel carries too much weather helm, an addition to head-sail or reduction of after-sail will ameliorate it; and he equally knows that, if a vessel is deficient in stiffness, the application of a lead keel will make her stiffer; but if he were told to *shorten* the arm of the couple upon which acted the force that was turning the vessel's head towards the wind, or to *lengthen* the arm of the couple upon which the statical stability of the vessel depended, he probably would not know what was meant. Now it may be argued that, if a man knows what to do to correct certain objectionable conditions, it does not matter whether he can account scientifically for the cause and effect, or for the evil and the cure. But it is obvious that a man, although expert in the practice of his art so long as everything worked smoothly, would be liable to meet with a check if any adverse condition refused to yield to remedies within his experience; whereas, if he had a knowledge of the underlying principles of his art, the remedy would be suggested because the cause of the evil would be known. However, the object in view is not to instruct sailing masters in the scientific principles which govern their art, but to give such instruction and knowledge of the practice of that art as may be of service to the purely uninitiated novice. This knowledge can be most readily imparted if a clear understanding is first arrived at of the principles and properties which scientific research has determined to govern the performances of sailing vessels. With this purpose in view, will be given, in as succinct form as may be compatible with clearness, a statement of those principles and properties before the general subject of the management of a vessel when under sail is entered upon. The exact application of principles or the determination of properties referred to would be beyond the scope of this work, and can be acquired from some modern work on naval architecture, such as "Yacht Designing."

CHAPTER I.

DISPLACEMENT AND BUOYANCY—STABILITY.

DISPLACEMENT AND BUOYANCY.

The displacement of a vessel is the quantity or bulk of water (generally represented by a measure of weight) which a vessel displaces or pushes away when she is put into the water. This quantity of water is always equal to the whole weight of the vessel and everything that she contains; that is to say, the vessel will sink into the water until she has displaced a quantity of the fluid equal to her own weight and the weight of everything that she contains.

If the weight of water displaced is exactly equal in *bulk* to the *bulk* of the vessel, then the latter will sink in the fluid until her entire bulk is immersed; or, in other words, if the body immersed be a solid of the specific gravity of the water, then will the solid sink into the fluid until it is entirely immersed. For example, a cubic foot of African oak weighs 62lb., a cubic foot of fresh water weigh 62½lb., and consequently, if a cubic foot of African oak were placed in fresh water, it would nearly sink to the level of the surface; but a cubic foot of *sea water* weighs 64lb., and consequently, if a cubic foot of African oak were placed into sea water, it would sink until 62lb. of the fluid were displaced (which would be less than a cubic foot), and would sink no deeper, so practically 2lb. of the oak cube would remain above the surface.

This well illustrates the meaning of the term "a vessel's displacement." A vessel weighs, we will say, with all her ballast, spars, sails, gear, stores, crew, and everything belonging to her on board, one ton; then, if she is put into the water, she will *displace* exactly one ton of the fluid. Now a ton of sea water in bulk contains 35 cubic feet; consequently, if the *bulk* of the vessel only equalled 35 cubic feet, she would sink into the water until entirely immersed. But a vessel that weighed one ton would contain in *bulk* a great deal more than 35 cubic feet, measuring her actual body on the outside from deck to keel as if she were a solid;

that is, the whole body or bulk of the vessel so measured would probably equal 50 cubic feet. The result would be that the vessel would sink into the water until 35 cubic feet of the hull became immersed, and this would leave 15 cubic feet above water.

The buoyancy of a vessel may be taken as a force equal to the weight of water it displaces; or, in other words, any given weight of fluid will support a similar solid weight. The quantity, or bulk, of a fluid which a vessel will displace depends upon the density of that fluid, as previous explained. Thus sea water is denser, or more buoyant, than fresh water; and, consequently, a cubic foot of sea water will support a greater weight than a like quantity of fresh water. Mercury is a fluid so dense that even iron will float in it with only a little more than half its bulk immersed, for the reason that a cubic foot of mercury weighs 849lb., whereas a similar bulk of iron only weighs 480lb.

Thus the displacement of a vessel is always equal to her own weight, including *everything* and *everybody* on board; and, providing that the bulk or size of the body of water displaced is smaller than the bulk or size of the vessel (regarding her from deck to keel), then a portion of the vessel will always be above the surface of the water, and this portion of a vessel is called her freeboard, and sometimes "surplus buoyancy."

The truth of the foregoing can be demonstrated by a simple experiment. Take a large basin, such as A (Fig 1), and fill it carefully to the brim with water, and stand it in the saucer, C. Then take a smaller basin B, and put it into the water, which of course will overflow into the saucer. If the water that so overflows and the small basin be afterwards put into a scale and separately weighed, they will be found to be exactly equal; and, further, if shot or other substance be put into the small basin B whilst it is floating, still more water will overflow, and if the whole of the water which so overflows be weighed, and thesmall basin and its contents be weighed, their respective weights will be proved equal.

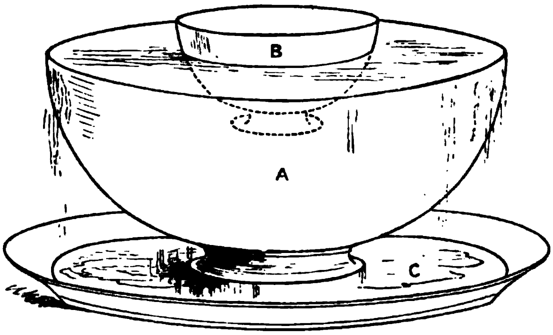


Fig. 1.

This experiment can be utilised to arrive at the displacement of the ship from that of the model. Thus say a model of the Kriemhilda is made to half an inch scale (or one twenty-fourth of her real dimensions), and put into a trough filled with salt water to the edge of a waste pipe; then as the model became immersed, the water would escape by the waste pipe into some vessel, say a large bucket. The escaped water in this particular case would weigh 18·65lb. Now the displacement of the ship to that of the model is simply as the cube of the difference in the dimensions; or say the scale for the ship is twelve times greater than that for the model; then the displacement or weight of the model multiplied by the cube of 12 ($12^3=1728$) would give the displacement of the ship. In the case given above, the scale for the real yacht was to be twenty-four times greater than that of the model, the weight of which was 18·65lb; the cube of 24 is 13,824 and 18·65lb. multiplied by 13,824 is equal to 257,817lb. There are 2240lb. to one ton; then 257,817 divided by 2240 gives a quotient of 115·59 tons, the exact displacement of Kriemhilda. If the model is made to other scales the displacement can be found by a similar process.

Scale to 1ft. INCH.	Proportion to real ship.	Cube of proportion by which the weight of displacement of the model is multiplied.
1	12	1728
¾	16	4096
⅝	19·2	7077·8
½	24	13824
⅜	32	32768
¼	48	110592
⅛	96	884736

CENTRE OF BUOYANCY.

The centre of buoyancy of a vessel is the centre of the cavity or hole made in the water by the part of the vessel which is immersed; hence it is frequently termed the centre of gravity of the displacement. In speaking of the centre of buoyancy of a vessel, such as a yacht or a ship of any kind, only that portion which is immersed is necessarily considered, so that in fact the vessel is treated as if she were cut down to the surface of the water. The centre of buoyancy of an immersed solid of similar sides, Fig. 2, or of an immersed sphere, would necessarily be in the

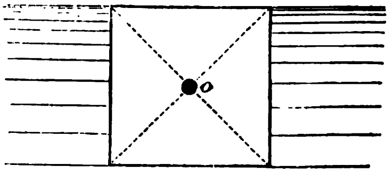


FIG. 2.

centre of the block at *o*—that is, would be equidistant from both sides and ends.

But a yacht is not shaped like a rectangular block, nor like a sphere, and, owing to such a vessel's irregular form, the centre of buoyancy is seldom at the mid-length of the hull, nor at its mid-depth; but, inasmuch as both sides of a yacht are, or ought to be, alike, the centre of buoyancy is always in the mid fore-and-aft line.

STABILITY.

It has been said that the weight of water which a yacht or vessel of any kind displaces is equal to her own weight, and consequently the pressure of the water on the immersed vessel is equal to her own weight. This pressure is diffused all over the immersed part of the hull, and the pressure of any individual particle of water on the hull is in a direction at right angles to the point of contact. The concentrated pressure, or the resultant of the pressure, on the immersed portion of the hull, acts *vertically* through the centre of buoyancy; and, as before said, this pressure is equal to the weight of the ship. So here are two equal forces acting in opposition to each other, and balancing each other—the weight of the displaced water pushing upwards through the centre of buoyancy, and the weight of the ship pushing downwards through its centre of gravity; and these two forces never act in any other than a *vertical* direction.

The centre of gravity of a yacht or ship is a determinable point, where the action of all her weights is concentrated; therefore it is sometimes called, in relation to ships, the "centre of gravity of the whole mass." The "whole mass" includes the hull, ballast, spars, sails, fittings, crew, stores, and everything which the ship or yacht contains that is of any weight at all. If on a plank A (Fig. 3) a number of weights, *a a a a*, &c., be placed at any irregular or equal intervals, and the plank be made to balance on a pointed stake at E, then E will be the common centre of gravity of the plank and all the weights placed upon it. It follows in a ship that, if the weights are placed further forward,

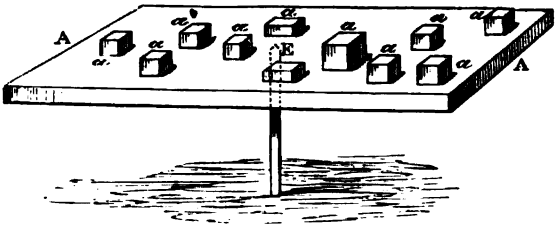


FIG. 3.

the centre of gravity will be shifted forward, and the contrary if the weights be shifted further aft. In a like manner, if the weight of the masts, sails, or gear be increased, the centre of gravity, with regard to its vertical position, will be brought higher; on the other hand, if the ballast be increased in weight, or if it be stowed deeper down in the hull, the centre of gravity, with regard to its vertical position, will be carried lower.

Thus we have two distinct, but balanced, forces—the weight of the water the ship displaces acting upwards through the centre of buoyancy, and the weight of the ship acting downwards through its centre of gravity.

A necessary condition for the ship to be in equilibrium is that the resultant of the two forces, represented by the weight of the ship acting through *o*, and the weight of the water she displaces, acting through *k*, should have effect in the *same vertical line.* (See *a a*, Fig. 4.)

If the direction of action of either be shifted, a struggle will instantly commence to regain a position where they will balance each other again, or act in the same vertical line. For instance, let a portion of a yacht's ballast or other weight be shifted forward until her centre of gravity is shifted from *o* to *s*, Fig. 4, then the yacht will sink down by the head until the two forces are directly over each other again as, *s* k^1, in the vertical line *b b*, Fig. 5 (p. 8).

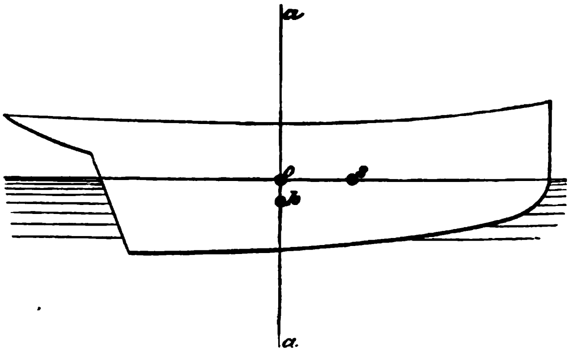


FIG. 4.

Now if the *centre of buoyancy* had been carried to k^1, by the vessel being in any way hove down by the head otherwise than by having a portion of her ballast or weight moved forward, she would regain the position depicted in Fig. 4 the instant the force or pressure which had hove her down was removed. This force that brings a vessel back to her original condition of equilibrium is called her righting power, or statical stability; and for the motion we have described would be termed her longitudinal statical stability. When a vessel is placed among waves, the centre of buoyancy is continuously carried forward or aft, as she is differently water-borne by the passing waves. A constant struggle is maintained between the centre of gravity of the vessel and her centre of buoyancy to keep in the same vertical line, *a a*, and an uneasy violent motion is acquired, whose force, to some extent, is dependent upon the urgency of the righting power. A vessel with her weights or ballast stowed low will have this righting power in a greater degree than one with her weights stowed high ; and she will be very quick in "recovering herself." So also will be a vessel that is very full on the load water-line, and very much cut away underneath; whereas a vessel with what is known as a long body will be comparatively easy in her motions during similar wave disturbance. The pitching and scending motions of vessels form a very complex problem, and are by no means wholly dependent on the conditions just adverted to. For instance, the *momentum* acquired during pitching, whilst the bow is left unsupported by the water, or scending, whilst the stern is without support, may be much increased by the distribution of the weights or ballast in a fore-and-aft direction, as the radius of gyration would be thereby lengthened; but the influence on these motions of any particular condition of a vessel can only be determined in a general kind of way, and are not amenable to any precise calculation.

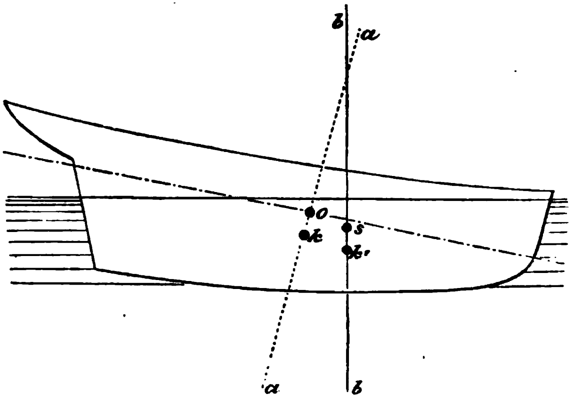


FIG. 5.

As a vessel's righting power is generally spoken of in connection with her heeling or rolling, it will be best to illustrate it in connection with these transverse motions.

Fig. 6 is a representation of a transverse section of a vessel supposed to be heeled to, say, 20°. E is her centre of buoyancy in her *upright* position, and F her centre of gravity. Upon being heeled or inclined, the centre of buoyancy, owing to the irregular shape of the vessel, shifts to some point, E^2. As the centre of buoyancy has been shifted to E^2, the resultant of the *water pressure* no longer acts through E, but through E^2; and it must be remembered that this resultant always acts vertically, or at right angles to the water-level. The resultant of the force represented by the weight of the ship continues to act vertically downwards through the same point, that is, through her centre of gravity F, it being assumed that no part of the weight of the ship has been shifted, so as to cause her centre of gravity to shift.

Thus we have the weight of the ship acting downwards through the centre of gravity F, in a direction F H, and the weight of the water displaced acting upwards through the centre of buoyancy E^2, in the direction E^2 M; and the point M, where E^2 M cuts the middle line of the upright position of the ship, is the meta-centre. The length of the righting couple is the horizontal distance between F H and E^2 M, represented in Fig. 6 by F K or x G.

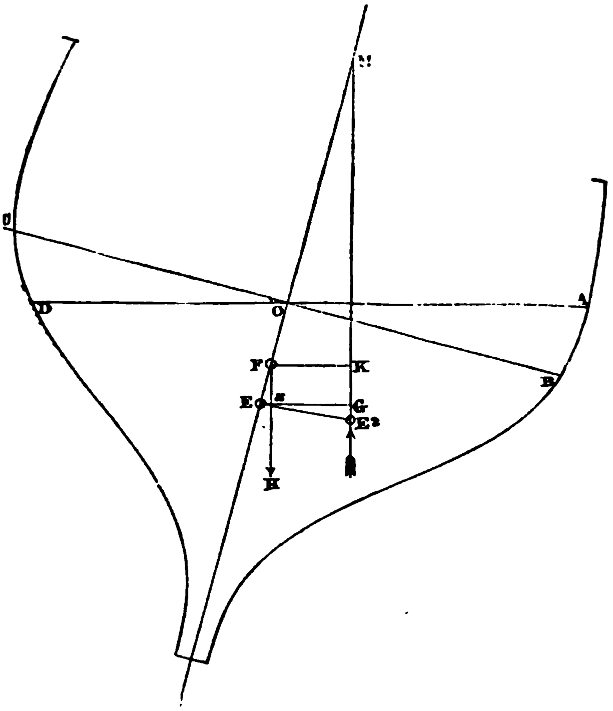


Fig. 6.

The wedge-shaped piece of the hull A B O is called the wedge of *immersion*; and the wedge-shape piece O C D the wedge of *emersion*. By naval architects they are usually referred to as the "in" and the "out" wedges. By the wedge of immersion, or the part that is put into the water, being largely in excess of the wedge of emersion, or the part that is taken out, the centre of buoyancy is made to shift very rapidly over to leeward as the vessel is inclined, and so the couple x G lengthens very fast. In all broad and shallow vessels the wedge of immersion, even at small inclination, is much in excess of that of emersion, and so they have considerable stability at small angles of heel—which may be conveniently referred to as initial stability—which stability, however, rapidly vanishes as the deck becomes immersed.

In saying that the wedge put into the water is *larger* than the one taken out, it must not be supposed that the displacement is increased in proportion to the excess. *The displacement always remains exactly the same as the weight of the vessel;* but if the volume of the wedge of immersion be in excess of the volume taken out, then the vessel shifts or rises bodily in the water, to an extent which is dependent upon the *area of the load water-plane and the excess in the volume of immersion.*

The righting moment or power is computed by multiplying the weight of the ship, or displacement in tons, by the length of the righting couple x G. That is, if the weight of the ship or her displacement be 40 tons, and the length of the righting couple at 20° inclination be 2ft., then her righting power or *moment of stability* at that inclination will be $40 \times 2 = 80$ foot-tons. If the righting moment of a yacht at 20° inclination be equal to 80 foot-tons, as described, then it will require a steady force equal to 80 tons upon her canvas to mantain her at that inclination.

If a vessel with such a section as that portrayed in Fig. 7 were filled out in the garboards at O O just above the keel, it is plain that the centre of buoyancy (B) would be lowered, and the point M would be brought nearer the centre of gravity (G); therefore the arm of the righting lever G Z would be shortened. But in the case of a yacht the added displacement about O O would be utilised for the stowage of additional ballast, and by this means the centre of gravity (G) would be brought lower; so that it is quite possible that the original distance between Z and G would be maintained.

The effect of increasing the height of the centre of buoyancy relative to the surface of the water can be illustrated in this way. Assume that the displacement, or rather the hull, is cut away at the garboards as shown at P P, and added to the hull near the load water-line as at R R, then the centre of buoyancy would be higher, and upon inclination of the vessel would shift out farther to leeward than shown by B′, so that the distance G Z would be increased, always supposing that G was kept in its original position by shifting the weights lower, such as could be done by putting additional weight on the keel. If the centre of gravity could be brought to K, and with the centre of buoyancy at B, the length of the righting lever would be K L. As a matter of fact, however, we know of no instance in a yacht where the centre of gravity has been found *below* the centre of buoyancy.

It is obvious that the *weight* of a vessel has largely to do with her stability; thus, if the length of righting lever at 20° inclination be 2ft., and the weight of the vessel only 35 tons, then it is plain that the righting moment at 20° inclination will only be 70 foot-tons instead of 80 foot-tons. Therefore, in considering stability, the problem that exercises the naval architect in designing is how to attain a given maximum righting moment; that is, shall he increase the beam and diminish the displacement, and thereby lengthen out the righting couple represented by G Z Fig. 7? or shall he contract the beam and add to the displacement at O O, and thereby largely add to the weight that will act on the couple? Of course, by adding to the beam and decreasing the displacement better lines for speed can generally be obtained; but, on the other hand, the longer and fuller-bodied vessel will most likely be the better or more easy sea boat, and will have a greater range of stability.

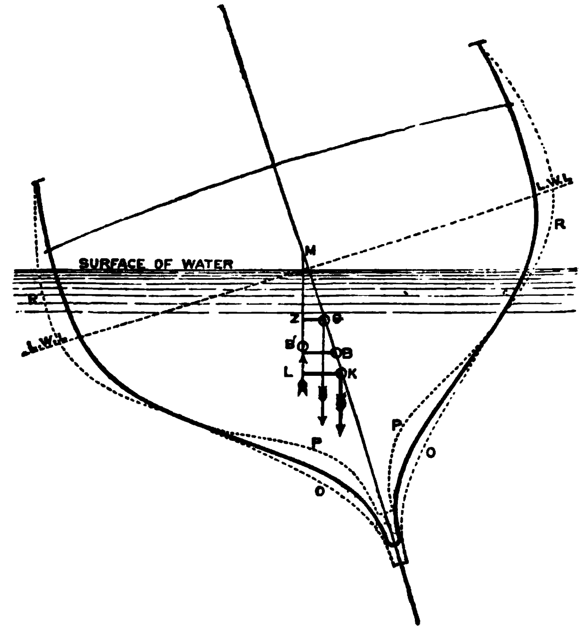
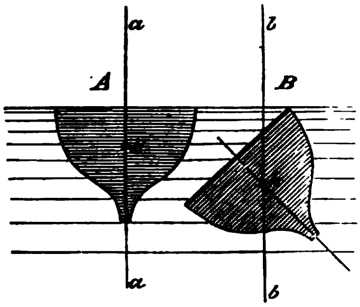


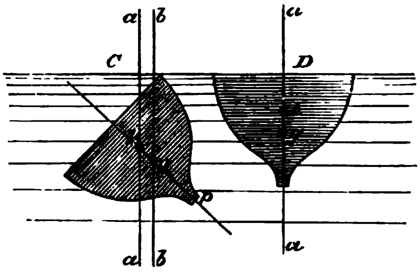
FIG. 7.

It is quite a common thing to hear a person say that this, that, or the other vessel has "great artificial, but very little natural or structural stability," as if there wore various kinds of stability. This confused way of regarding stability is very likely to prevent a clear understanding of the conditions on which stability depends, and it must be understood that there are no such things as "artificial stability" or "natural stability" or "structural stability" or "stability of form" as distinct qualities. In "Yacht Designing" in reference to stability we find the following:

> There is no such thing as stability of form *per se*, although it is sometimes convenient to speak of form as if it had absolute stability *independent of the position of the centre of gravity of the vessel.* For instance, let it be conceived that a body of no weight be placed in a perfect fluid, then it would rest as well in one position as another, whatever its form; so that when stability of form is referred to it must always mean the influence that form has on stability in relation to the centre of gravity of the body and its metacentric height.

Or it may be assumed that a homogeneous substance is placed in a fluid, or that a portion of a fluid is turned into a solid, maintaining its inherent bulk, weight, and specific gravity; then such a substance or solid would float in whatever position it were placed. Let A be such a substance or solid; then its centre of buoyancy and centre of gravity must necessarily be at the same point, *k*; and, as the resultant of these two forces acts in the vertical line *a a*, the body will be in equilibrum if placed in the position—which may be assumed as its natural one—A. But A will be in equilibrium in any other position; for instance, in that shown by B, as the two forces still act in the same vertical line through *k*, as shown by *b b*. It is thus evident that such a substance or solid has no *stability* whatever.

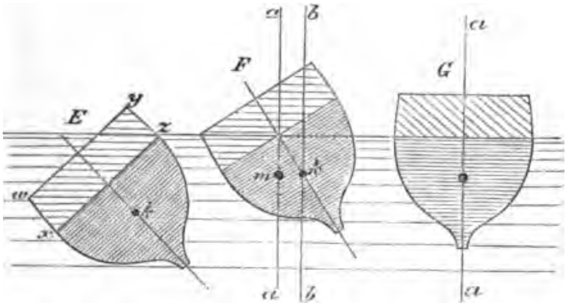




Now the equilibrium can be made *stable* by shifting the point through which the centre of gravity acts. Assume that the specific gravity of the solid, B, is made unequal, so that it becomes denser or heavier about *p* (see C); it is apparent that on such a change the *centre of gravity* would be shifted to some point, *g*, and the forces would no longer be acting in the same vertical line. The resultant of the buoyant pressure of the water would act upwards in the line *a a* through *k*; and the resultant of the weight of the body would act downwards in the line *b b* through *g*.

The horizontal distance between the two lines *a a* and *b b* would be the *couple* upon which the two forces acted, until the solid got into the position D, where the two forces would act in the same vertical line, *a a*. The equilibrium of a solid such as D floating would be *stable*, if, upon being inclined from its original position until in the position C, it had the power to regain the position D.

It has been proved that "form" of itself has no stability, and it remains to be shown how the variableness of form in a *partially* immersed body can bring about a stable condition of equilibrium. Let it be assumed that the solid A has an addition made to it, as illustrated in E by *w x y z*. The *bulk* will be increased, but the *weight* is to remain exactly the same, with the centre of gravity still at *k*. The body will rise in the water until in the position F, so that a part remains immersed equal in *bulk* to A. Owing to the altered *form* of the immersed part of the solid, the centre of buoyancy has shifted to some point *m*, but the centre of gravity remains at *k*. Now the resultant or buoyant pressure of the water in the line *a a* no longer acts through *k* but through *m*, whilst the weight of the solid still acts through its centre of gravity, *k*, in the line *b b*. It is quite plain that the solid could not remain in the position F, but would take the original position of A, as shown by G, with the forces of buoyancy and gravity acting in the same vertical line *a a*.



CHAPTER II.

CENTRE OF LATERAL RESISTANCE.

LATERAL resistance is the resistance the water offers to a vessel being moved sideways or laterally; and the *centre of lateral resistance* is usually understood to mean the centre of the vertical longitudinal section of the immersed portion of the vessel, including the rudder. In other words, this immersed longitudinal section is assumed to be a plane; and if this plane be moved through the water in a direction at right angles to its own (the plane's) surface, then the resultant of the resistance it will meet with will act through its centre. For instance, let Fig. 8 be the immersed longitudinal section of a vessel with its centre at x. If a towing line were attached to the point x, the vessel or plane would be towed laterally or "broadside on" through the water, without exhibiting any tendency to turn one way or the other; in fact, the plane representing the longitudinal section of the vessel would keep normal, or at right angles to the towing line. But if the towing line be attached farther aft, then on being towed the stern would come round towards the line; or if attached farther forward, the bow would turn round towards the line.*

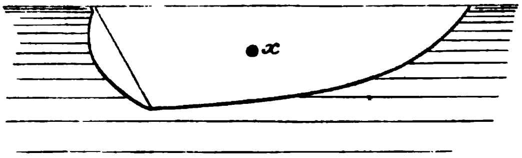


FIG 8.

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* A simple experiment conducted as indicated with any model and piece of string will determine the centre of lateral resistance, disregarding its actual position, due to forward motion, and which motion would not be given to the model during the broadside towing. The centre can also be found by taking a piece of board shaped to represent the longitudinal immersed section of the vessel, and suspending it with a plumb line attached to the point of suspension. Mark where the plumb line cuts the board, then suspend the board from another point, and mark where the plumb line intersects the other plumb line mark; the intersection will be the centre. The centre of buoyancy can be determined by a similar experiment; the model for such purpose must be made of clean stuff, and cut down exactly to the water's edge,

In calculating the centre of lateral resistance of a ship or yacht, it is always assumed that a plane has to be dealt with, and the immersed longitudinal section is taken as that plane. As a matter of fact, the centre of this plane would not be the centre through which the resultant pressure on the side of the ship would act. Owing to the varying form of a ship or yacht, it is almost impossible to determine by calculation the point through which the resultant of the *horizontal* pressure of the water actually acts; and, moreover, if the exact point could be readily determined, the knowledge of it would be of small practical value, for the reason that, owing to the forward motion of the vessel, there is an increase of pressure on the bow and a deficiency at the stern; and, further, even supposing the centre of pressure could be accurately calculated for the upright position, it would be useless for any other position of the vessel, as a different portion of her hull would be immersed, or its position relative to the horizon altered, each time the vessel rolled or was heeled.

The use of knowing the position of the centre of lateral resistance is that the "handiness" of a vessel can be regulated thereby; and for this use the centre of the plane described by the immersed longitudinal section of a vessel is, fortunately, a sufficiently determinate point, as will hereafter be shown.

It need scarcely be pointed out that a flat surface is more effective in resisting lee way than a convex one; hence a vessel with a large area of dead wood aft, a very sharp flat entrance, and a deep keel will make less lee way than one that has a less flat surface immersed, all other things being equal. It must always be remembered, however, that the upper part of the dead wood aft, owing to the disturbed water it passes through, meets with less pressure than that forward. Hence "drag," or a much greater draught aft than forward, has been found of great use in keeping the centre of lateral resistance in a required distance aft, as the lower parts of what may be termed a raking keel are continually being moved into solid or undisturbed water. This matter was very pertinently urged by a correspondent under the signature of F. M., in *The Field* of March 29, 1873. F. M. thus illustrated the effectiveness of "drag" aft (see Fig. 9):

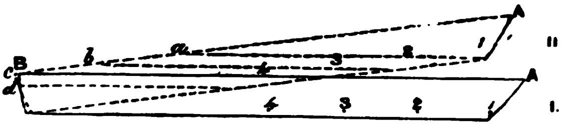

FIG. 9.

Let A B (1) represent the sheer plan of a keel, and suppose that the vessel to which it belongs is sailing close-hauled, and take for convenience the points 1, 2, 3, 4, on the lee side. Point 1 is gliding past, and being pressed sideways against any given particle of water x; point 1, therefore, gives x a push sideways; so that when point 2 arrives at x it finds that x, having been put in motion by point 1, is gliding away transversely; point 2, therefore, meets with less resistance to its transverse motion or lee way, and is less effective than point 1. In a similar manner points 3 and 4 in the keel are less effective than point 2. In short, we may easily imagine that at a short distance from the fore foot the water put in motion by the fore part of the keel is moving away sideways faster than the keel can follow it up, and all the parts of the keel aft of this point are non-effective in preventing lee way. Assume that two-thirds of the keel are really effective, and worth their skin resistance, then let the same keel be inclined upwards (II.) at such angle as to make the largest of the sections 1*a*, 2*b*, 3*c*, 4*d*—which are parallel to the water line—equal to two-thirds of the whole length of the keel. It is now clear that each of the points 1, 2, 3, 4 is practically a point in the fore foot, for it is cutting into fresh solid water undisturbed by the parts of the keel in front of it. It follows from this that in certain cases, by rounding off a yacht's fore foot and rockering her keel, she may be made not only more handy in stays but actually have her hold on the water increased, although the area of the keel and gripe may be reduced considerably by the alteration.

Following up this reasoning, many yachts are designed with very "raking" keels;* but at the present time most designers of racing yachts prefer the rockered keel. By having the greatest draught, or what might be termed the termination of the effective surface for lateral resistance, amidships, the after part or heel of the keel can be very much rounded up—something in the fashion of the fore foot; and, as this is done the necessity for a great rake to the stern post is done away with, and the stern post is straightened forthwith. The effect is, that for the same tonnage—it is assumed that the stern post on deck is kept at the same distance from the stem piece—a longer after body can be obtained, and presumably a more capable, a larger, and faster vessel. Beyond this, a deeper middle body is obtained, and this is found of the utmost advantage, as it admits of the weights being stowed lower without being much distributed in a fore-and-aft direction.

The effectiveness of triangular centre-boards is well known, and it is astonishing how small a piece of board will check lee way, providing the board is deep and not long. One supposed disadvantage—especially in small boats—of a keel very much rockered, or of a centre-plate instead of a keel, is that in very disturbed water a vessel's head, in beating to windward, gets "knocked off the wind," but it is overlooked that if the bow is readily knocked off the wind the same facility exists for "coming-to" the wind during favourable puffs. A vessel with a much rockered keel will probably steer wildly off the wind, and will require watching, and on any point of sailing she is likely to run off her helm.

To meet these drawbacks, some eastern boats (such as those of Bombay) have cambered keels, *i.e.*, the reverse of rockered, as the back of the arch is turned upwards; and a few boats in America and in this country have been fitted with double boards. However, we think that the balance of advantages for close-hauled sailing are overwhelmingly in favour of the rockered keel or the centre-plate; and if the vessel is quick in falling off, she will be equally sensitive in coming to; and a careful helmsman will take his "rocker" farther up to windward than any similarly careful helmsman could a "straight keel," all other things being equal. It is undeniable, however, that in sailing very much off the wind the craft with "drag," or a large area of dead wood aft, will require much less helm than one whose heel is rounded up—that is, she will have less tendency to yaw.

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* The Jullanar has a draught of 14ft. aft, and only 1ft. 2in. forward. (See "Hunt's Yachting Magazine," July, 1877.)

CHAPTER III.

EFFORT OF THE WIND ON SAILS—CENTRE OF EFFORT.

EFFORT OF THE WIND.

If a vessel were always sailing before the wind, or nearly so, no illustration would be necessary to show how the impulse of the wind acts as a propelling power; but, as a vessel can be made to move ahead nearly "in the wind's eye," or, in other words, almost in direct opposition to the direction of the applied force, it is evident that a curious problem has to be solved in accounting for close-hauled sailing. In Fig. 10, D E is a vessel moving ahead in the direction of the arrow and the line D E. The letters F G represent the boom and projection of a sail. The arrow W marks the direction the wind is blowing towards the vessel, *i.e.*, four compass points, or 45°, from her course. The line F H shows the direction of the wind (which is, of course, the same as the arrow W)* relative to the plane of the sail, F G. The length of the line F H represents the *force* or strength of the impulse of the wind on the sail.

At the first view it would seem that the force of wind coming from such a direction as W upon a sail trimmed at such an angle as F G could only drive the vessel astern in an oblique direction; but the force F H as it strikes the sail is decomposed or resolved into other forces, so that in reality the force is not exerted in the direction that it is apparently applied to the sail. The line F H will be regarded as the *diagonal* of a parallelogram or four-sided figure, such as F G H I. The wind F H by the construction of the figure is resolved into two forces—the first, F G, along the plane of the sail or direction of the boom, and has little or no effect; the other force is exerted at right angles to the plane of the sail, and in Fig. 10 is represented by the line F I.

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* This is the *actual* direction of the wind; the *apparent* direction is indicated by the vane on the top-mast and is the direction that should be taken for strict illustrations. (See "Yacht Designing," page 64.)

Now the force F I (which represents the whole horizontal exertion of the wind on the sail) is apparently employed in driving the vessel sideways, although at the same time a little ahead; but F I (the force exerted on the sail) is decomposable into two other forces, thus: let F I be the diagonal of a parallelogram F *a* I *b*; then the line F *b* represents the magnitude of the force that is driving the vessel to leeward in a direction at right angles to her keel; and the line F *a* represents the magnitude of the force that is driving her ahead in the direction of her keel.

If a vessel resembled a true hemisphere, with no keel or dead wood of any kind, it is certain that she would proceed to leeward in the direction F *b* much faster than ahead in the direction F *a*; but a yacht is so formed that she offers very great resistance to lateral or sideway motion, and very little to headway. In a general way, in similarly formed vessels, the difference between the resistance to lateral motion and to forward motion is proportional to the area of the midship section and the area of the longitudinal section, it being always understood that only the immersed portions of these sections are referred to. The proportion roughly is as 10 to 1; but for any individual vessel the actual relative value of the lateral and head resistance will depend upon the form of the vessel.

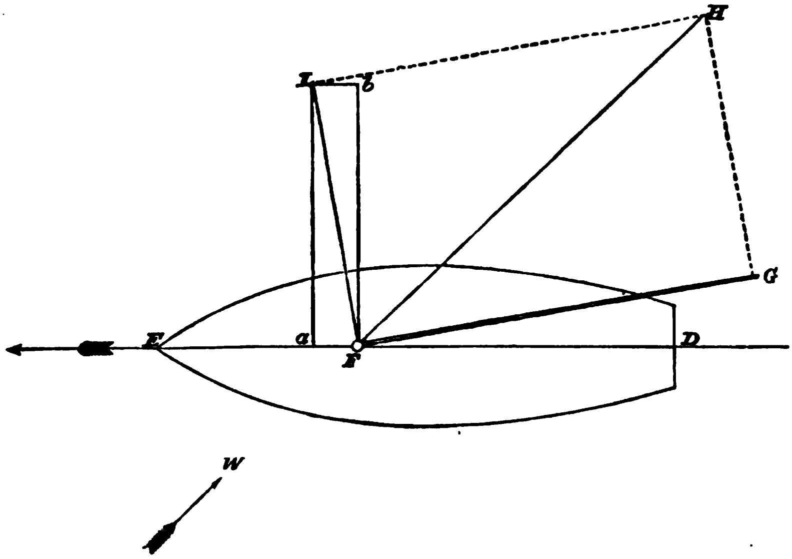

Fig. 10.

The *vertical* component of the pressure tends to add to the immersion of the vessel; but unless she were heeled to a very considerable angle this part of the pressure would have little effect, and in no case could serious or important consequences arise through the extra immersion due to the vertical pressure of the wind.

CENTRE OF EFFORT AND PROPULSION.

If the wind always blew at right angles to the plane of a sail, the effort of that wind would be exerted through the centre of gravity of the sail plane; that is, if the whole effort of the wind were concentrated on one point of the sail, that point would necessarily be the centre of the plane. This point is usually termed the "centre of effort" of a sail. If a vessel has many sails, such as a cutter yacht, Fig. 11, the total effort of the sails is exerted through a point which represents the centre of gravity of the *whole* of the sails combined. In Fig. 11 the centre of effort of each sail is marked at *a b c d* (*d*, for the topsail, appearing in cut as *a*), and the common centre of gravity of the four sails lies at the point, C E, and this point is termed the CENTRE OF EFFORT of the sails.

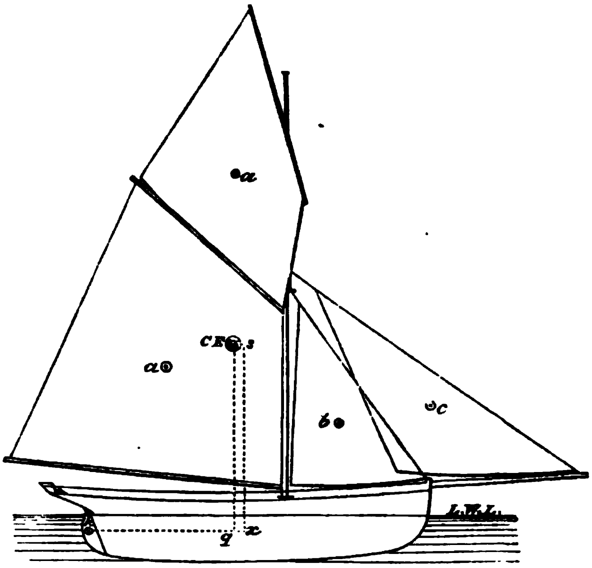

FIG. 11.

The most effective angle for the sails to make with the direction of the wind can be theoretically determined upon the assumption that the sails are real planes, and not such as they are, more or less concave surfaces. In "Yacht Designing" this problem is worked out in detail, together with the speed per hour a vessel of 150 tons ought to make upon different points of sailing, assuming the sail area and force of the wind to be constant, as follows:—

Angle of yacht's course to direction of *real* wind in compass points.	Angle for sails of yacht with her keel.	Speed of the yacht per hour in knots.
3½	9° 20′	6·50
4	10° 15′	7·30
4½	11° 30′	8·00
5	12° 30′	8·75
6	14° 40′	10·00
8	19° 30′	11·20
10	27°	11·40
12	37°	10·40
16	90°	8·90

(It must be understood that the "sail angle" set forth in the table is purely theoretical, and in practice the sails will be trimmed according to the requirements of the vessel and the judgment of the sailing master.)

The "real wind" is the true direction of a wind, such as would be indicated by a vessel's vane if she were at anchor or motionless. When a vessel moves obliquely towards the wind, the direction of that wind, as shown by the vane, apparently alters or draws more ahead in the path of the vessel, or, in other words, the vane blows nearly fore and aft. This *apparent* wind is the force that had to be considered in solving the problem referred to above; but in speaking of the course a vessel makes with the wind the *real* direction of the wind is understood. In beating to windward this real direction can be readily determined by aid of the compass; thus, assuming a vessel on one tack heads N.W., and when put about that she heads N.E., then between N.W. and N.E. are eight compass points, and the vessel on either tack evidently had pointed four points from the direction of the real wind, which was at N.; but the course, if judged from the vane or flag, would probably be set down as only three points from the wind. The vessel would be said to "turn in eight points" if there were only eight compass points in the arc she described in being put from one tack to the other.

From the table just given we learn that a yacht's speed increases as the angle of her course with the real wind increases, until she brings that wind a little abaft the beam (the vane would show the wind a little forward of the beam), and we have a difference of speed of nearly a knot an hour set down between the courses of 3½ and 4 points. This seems a very important difference, and it will be well to inquire if by "squeezing" a vessel so close to the wind the loss of speed is compensated for. In beating to windward the proportion the real distance to be reached bears to the distance traversed is for 3½ points as 1 is to 1·3; for 4 points, as 1 is to 1·414; for 4½ points, as 1 is to 1·6; and for 5 points, as 1 is to 1·825. Thus, if a vessel had to beat twenty miles dead to windward, the distance sailed, according to the following courses, would be:

3½ points	20 × 1·3 = 26	miles
4 points	20 × 1·414 = 28·3	„
4½ points	20 × 1·6 = 32	„
5 points	20 × 1·825 = 36·5	„

There unquestionably could be a great gain here in economising distance, but the matter for consideration is this: would the gain in distance compensate for the loss in speed? As we know what the speed per hour is on different points of sailing, this question can be answered by a very simple calculation. Thus:

	Hours.	Minutes.
3½ points from the wind	4	0
4 „ „ „	3	53
4½ „ „ „	4	0
5 „ „ „	4	11

Thus, say, two cutters of 75 tons each, equal in every respect as to speed, stability, and spread and effectiveness of canvas, set out to beat 20 miles to windward, and one lay 3½ points from the wind and the other 4½ points, there would be no loss or gain; but if one of them lay 4 points from the wind, she would gain 7 minutes, and if she lay 5 points from the wind she would lose 11 minutes. Thus for a cutter beating to windward a course of 4 points from the wind would appear to be the most advantageous.

It must not be supposed, if of two vessels of 75 tons each one is a schooner, and the latter makes a course of 4½ points from the wind, and the cutter 4 points, that there will be, providing their general speed and area of canvas be equal, only seven minutes' difference between them at the end of a twenty miles' thrash to windward. The schooner will probably be the equal of the cutter with the wind abeam; but it is a very different matter when the wind and the sails make a very small angle, as in close-hauled sailing. For such sailing a great portion of the sails near the upper, lower, and after edges are ineffective; consequently, the more parts a vessel's sails are in, the more edges there will be, and the greater the loss of propelling power; and, further, the eddied wind thrown off by the sails greatly interferes with the direct currents of wind. Beyond this, a schooner suffers in stability, inasmuch as she has to carry the weight of two masts and two sets of rigging, instead of one mast and one set of rigging; for this reason, she would have less stability than the cutter (though otherwise she might have been equal to the latter in stiffness), and would not carry her canvas so effectively, as the area of canvas practically is reduced in proportion to the sine of the angle of heel.

This leads us up to the point that sails are not really planes, but surfaces which are more or less concave. There is no doubt that the general *pressure* on a surface is equal whether that surface be a plane or a concave one, providing the areas are equal; but, on surfaces like those of sails, it is not the direct pressure (such as it would be when sailing dead before the wind) that drives a vessel ahead, but a component of the wind force which strikes the sail at some angle, as previously explained. The exact value of this component for a concave surface is, so far as we know, undeterminable; but experience has taught us that it is vastly larger for flat surfaces. The oft-quoted example of the America's sails as against the wind-bags of British yachts in 1851, and the practice in consequence of the last quarter of a century, are sufficient evidence of the truth of this.

When the wind force applied to a sail comes obliquely from ahead, as in close hauled sailing, there is a plus pressure on the fore part of the sail, and Mr Osborne Reynolds has very completely proved that the centre of pressure is far ahead of the centre of area, as indicated by the letters *a, b, c, d,* Fig. 11. Let A (Fig. 12) be a projection of a plane moved obliquely through water or the air, in the direction of the arrow, by a line attached at *p*. So long as the line is kept attached at *p* the plane will keep in its oblique position, and the centre of pressure will be at *p*; but if the line were attached to the centre of the figure at *x*, the plane would move square to the line of pull, as shown by B, and the centre of pressure would necessarily be at *x*. Mr Wm. Froude has given this subject a great deal of attention, and, in speaking of sails, says:

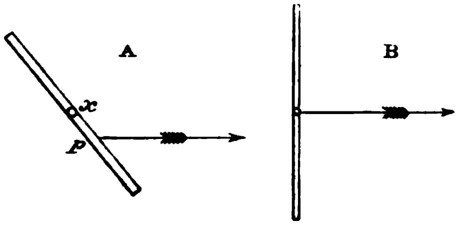

Fig. 12.

> A striking indication of a distribution of fluid pressure on a curved surface is supplied by the *primâ facie* paradoxical curvatures into which sails often arrange themselves under the effect of wind, as is specially noticeable in jibs. In these sails especially many sailmakers, for reasons which it would be out of place to enter on here, cut the canvas with an extravagant roundness or convexity of outline on the anterior edge of the triangle (or "luff of the sail" as it is called) before roping it; and as the rope is made somewhat shorter than the rectilinear dimension of the side of the triangle, the prominent edge of the convexity becomes gathered in, so as to form, immediately behind the rope, a narrow tapered belt of slack canvas, which becomes conspicuously bagged out by the pressure of the wind. Now it is a most noticeable fact, familiar doubtless to all who have studied the "sit" of sails, that when the vessel

which carries such a sail is "close-hauled," that is to say, when the wind strikes the sail obliquely from ahead, say at an angle of 45° with the line of the keel, the general wind pressure which the reaction of the rest of the sail produces swells out the "baggy" belt of canvas, not simply to leeward, but also so much forward that an observer viewing it in a direction at right angles to the vessel's course can see the convexity protruding itself ahead of the bolt rope, although, from the direction of the wind current as a whole, that part of the sail, when thus protruded by the internal pressure, must experience externally also a considerable direct pressure on its convex or (so to call it) leeward side. As the vessel is pressed closer to the wind, it is this part of the sail which will first begin to flap or "lift;" but this will not happen until the greater part of the windward surface of the sail is brought so nearly edgeways to the wind, that the flatter, or less "baggy," portions of its surface are nearly relieved of pressure.

There is no doubt that, if the fore part of sails did not go into the "bag" described by Mr Froude, they would be much more effective; and, within certain limitations, the heavier the canvas, or the more rigid and unstretchable it can be made by narrowness of cloth or other means, the more wind will the sails usefully resolve. Sailing masters generally well understand the importance of having the fore part of a sail flat and "unbaggable." Hence, during a match, we frequently see them wetting the luff of a main sail, to shrink the flax and so strain this part of the sail flatter. But in old-fashioned sails (and in some ill-cut modern ones), the after part of the sail also went into a bag, and the idea was that the wind should not be allowed to escape. But the real effect of a bag in the after part is to make a "back sail;" and, of course, a back sail retards a vessel's progress, and, in the case of after sail, helps to turn the vessel's head towards the wind, by pressing her stern to leeward. This bagginess in the after part is more or less apparent in all sails, and in the case of one set on a gaff the mischief of the tendency to turn the vessel towards the wind is somewhat remedied as the peak goes off to leeward, so that actually only little more than half the sail remains at the angle the boom is trimmed to. The conclusion is that the general pressure on a baggy sail is the same as on a flat surface of equal area if that pressure be applied at right angles to the plane; but if applied obliquely the component of the pressure (represented by F *a*, Fig. 10) which drives the vessel ahead is smaller, with a baggy sail, whilst the pressure that drives her to leeward, and assists in heeling her, is much larger. Before the wind this is a matter of no consequence; but by the wind it is evidently of the utmost importance that the sails should be perfectly flat, and that they should be well cut, without folds or girts of any kind, and that they should never go into bags in consequence of the canvas being soft or elastic.

It has been said that the centre of lateral resistance represents the point through which the resistance of the water to the sideway motion of a vessel acts, and the centre of effort of the sails represents the point through which the force acts which endeavours to impart sideway or broadside motion to the vessel. It is therefore evident, if these two horizontal forces do not act in the same vertical line, that some disturbance must take place in the direction of the vessel's motion. In short, the *horizontal* distance represented by x q or C E s in Fig. 11 is a coupling lever tending to turn the vessel towards the wind. When such conditions exist, a vessel requires what is known as "weather helm;" that is, if the vessel's head has a tendency to fly up in the wind, the *rudder is turned to leeward* by bringing the helm or tiller to windward. (The distance k, x in Fig. 11 shows the length of the lever upon which the rudder acts to turn the vessel, but this part of the subject will be fully treated in the next chapter.) It is obvious that if C E were directly over x no lever would exist, as the force accumulated in C E would have no tendency to turn the vessel, either on or off the wind, and the vessel would "steer herself." If on the other hand x were at q, and C E at s, it is clear that the effort of the sails would be striving to turn the vessel's head *off* the wind, and she would in fact require "lee helm." Thus, two bad faults in a vessel whilst sailing by the wind are dependent on the fact that the centre of effort of the sails does not act in the vertical line in which is the centre of lateral resistance. It would appear to be a very simple matter to so arrange a vessel's sails that the centre of effort came over the centre of lateral resistance, presuming the latter to be determined; but, owing to the concavity of the sails, and the fact that the pressure varies considerably on them (there being always a plus pressure on the fore part or luff of the sail), the centre of effort cannot be accurately computed. That is, it is always some distance ahead of the calculated centre, as already shown; but, as the centre of lateral resistance is likewise ahead of the calculated centre, it is found in practice both safe and useful to treat the calculated centres as if they had been correctly determined. In "Yacht Designing," in summing up this question we find the following: "Experience teaches us that, to obtain the largest average of advantages, the calculated centre of effort of the sails should be some distance forward of the calculated centre of lateral resistance, and this distance may vary from ·01 to ·03 of the length of the load line. With such a ratio as ·03 the vessel may carry 'lee helm' in light winds and be slack in stays, and probably a ratio of ·02 will be a safe one to adopt. Thus, if a vessel be 50ft. on the load line, then 50 × ·02 = 1ft., = the distance the calculated centre of effort of the sails is to be ahead of the calculated centre of lateral pressure on the immersed surface of the hull."

This, it should be understood, refers to racing yachts; for mere cruisers it will be better and safer to have the centre of effort and centre of lateral resistance in the same vertical line. In the case of yawls it is generally found that the calculated centre of effort requires (relatively to the centre of lateral resistance) to be a little further aft than in either cutters or schooners, as the mizen is not a very effective sail on a wind.

As the longitudinal component (F *a*, Fig. 10, page 19,) of the force of the wind acts through the centre of effort of the sails considerably above the centre of lateral resistance a couple is formed (C E, *q*, Fig. 11) tending to depress the bow; but as the longitudinal stability of a vessel is so great, but little depression will actually take place. Thus take the case of Seabelle at a speed of 7 knots, her resistance in the water would be about half a ton and the distance (C E, *q*) is 50ft., and at such speed the moment would be (50 × ·5) equal to twenty-five foot tons, which would only cause Seabelle to be depressed by the head 1½in. Of course, as the resistance increased, as it would very rapidly in the case of vessels with full bows driven at high speed, the moment would increase and the bow would be further depressed. In small yachts and boats, which are made to carry sail areas (by aid of trimming ballast to windward) out of all proportion to their size, the depression of the head is often very considerable, and has to be met by shifting some of the ballast or crew farther aft.

CHAPTER IV.

THE ACTION OF THE RUDDER AND STEERING EFFICIENCY.

THE ACTION OF THE RUDDER.

A VESSEL moving through water is steered or turned by the action of a couple, the arm of which is the centre of lateral resistance and the centre of effort of the rudder (see *k x*, Fig. 11, page 20). The streams of water that meet the oblique surface of the rudder when it is put over represent a pressure which can be decomposed into a force acting at right angles to its surface; and it is evident that the application of this force would cause a vessel pivoted on a vertical axis through her centre of gravity to rotate about that axis, and the speed of the rotation would be dependent upon the magnitude of the force applied, the extent of area of the rudder, and the length of the arm of the couple before referred to. But a vessel is not so pivoted, and turns as it were in a ring and, at first, about an instantaneous axis, which does not pass through the centre of gravity of the ship. The following conditions dependent upon the putting over a rudder to turn a vessel are gleaned from a paper read by Dr Woolley before the British Association.

It will be assumed that Fig. 13 is a yacht proceeding in the direction of the arrow A. B is the rudder put over to starboard to an angle of 35° by the tiller being pushed to port, and the arrow D represents the magnitude of a force acting upon the rudder in a direction at right angles to its surface; *a* will be regarded as the point of application of that force; but the force D can also be taken as an equal force acting in a parallel direction through the *centre of gravity* of the yacht *x*, and shifting the vessel sideways in the direction of the arrow E, combined with the couple of the force whose arm is represented by the distance the centre of effort of the rudder, *a*, and the distance the centre of the lateral resistance, *o*, are apart.

The effect is that the direct forward motion of the vessel becomes altered to one of rotation in the direction shown by the curved arrow t about an instantaneous axis k, thus determined: draw $x\ q$ at right angles to D a through the centre of gravity; and draw $x\ y$ (*equal to the radius of gyration of the vessel*) at right angles to $x\ q$. Next join $q\ y$, and $y\ k$ is drawn at right angles to $q\ y$, cutting $x\ q$ in k produced; and k is the instantaneous axis. By "instantaneous axis" is meant the point upon which the vessel turns upon feeling the first influences of the rudder, and this point generally lies considerably before the centre of gravity; hence it always appears that the stern of a vessel moves much faster than her head in turning; and this is really so at first, but when the vessel is kept turning the axis of rotation shifts aft until it rests in the centre of gravity.

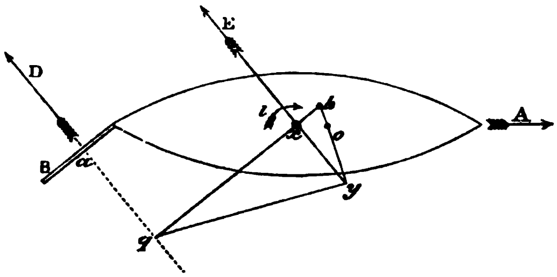

FIG. 13.

Components of the force in the direction E or D are employed partly in checking the vessel's way, and partly in driving her sideways nearly at right angles to her keel.* These components ultimately balance each other, and the vessel then continues to turn under the influence of the couple formed by $a\ o$ round a vertical axis passing through the centre of gravity, x. Dr. Woolley, in reference to handiness in turning, says:

"Sensibility to the helm, *i.e.*, quickness and readiness in a ship to go about, is a most important quality. At the first moment the angular acceleration, which is the measure of this sensibility, varies directly as the moment of the water-pressure on the rudder, and inversely as the product of the weight of the ship and the square of the radius of gyration about a vertical axis through the centre of gravity."

The angular acceleration or turning motion is at first very small, and its initial magnitude mainly depends upon the rapidity with which the rudder is moved so as to bring pressure on it, and upon the radius of gyration. As the angular velocity is accelerated, so does the resistance to rotation increase until the moment of resistance balances the moment of the couple formed by the pressure on the rudder. The angular acceleration, or turning motion, then becomes uniform.

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* When a yacht carries weather helm the rudder is turned to leeward, but the turning power of the rudder is balanced by the ardency of the pressure on the lee bow; hence the whole effect of the rudder is to check the forward speed and to press the vessel bodily to windward; it is quite possible that the latter influence may more than balance the leeway.

Now the moment of the water pressure on the rudder varies as the length of the couple *a o* and the area of the rudder; and the radius of gyration is dependent upon the length of the ship and the stowage of her weights, and thus a long vessel would have her already slow turning further diminished by the stowage of weights in her ends.* If the arm of the couple on which acts the pressure on the rudder be shortened, the steering efficiency will be diminished; and it has been contended that a raking stern post so shortens the arm of the couple. But, so far as we can judge, this is a mistaken contention, as generally the centre of lateral resistance is carried farther forward by the raking stern post than is the centre of effort of the rudder.

Beyond this, there is usually a much greater length of stern post when it rakes, and generally the area of the rudder is thereby increased, inasmuch as the breadth only of the rudder appears to be regarded as a matter of importance, and not its depth, so far as yachts are concerned. Some yachts with raking stern posts have enormous rudders, and, although there may be some danger in using them in the case of sternway and in scending, there is no doubt that they are efficient. But a rudder hung on a raking stern post is not wholly effective, inasmuch as a component of the pressure on it is exerted in a vertical direction, and tends to drag the vessel's stern under. This can only be regarded as a disadvantage, and a further disadvantage is that the rudder is difficult to put over, as it has to be lifted every time; but the latter difficulty is overcome by making the tiller longer than would be required for a similar rudder hung on an upright stern post.

With regard to resistance to rotation, this mainly depends upon the area of the immersed longitudinal section, and particularly upon the amount of dead wood fore and aft. By reducing the dead wood fore and aft the resistance is proportionately decreased, and, moreover, the radius of gyration would be somewhat shortened by the reduction of the fore and aft weight; but almost equal effects would be produced by taking away from the dead wood forward and aft, and concentrating it in the middle of the vessel under the keel. The effective surface for lateral resistance would be maintained, and the radius of gyration would be still shortened.*

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* The bad effect of weights in the "ends" of small boats is very noticeable, and we have known cases where a boat has been cured of her tendency to miss-stays by simply concentrating her weights or ballast amidships. On the other hand, a very old practice to insure a boat staying is for someone to get into the bow as the helm is put down; but the bow should be relieved of the weight directly the boat is head to wind, or the boat may fail to "fill" or fall off.

To sum up, the quickness of a vessel in answering her helm depends:

1. Upon the smallness of the weight of the vessel and her radius of gyration.

2. Upon the area of the rudder, and the length of the couple upon which it acts, and upon the time it takes to put the rudder over.

3. Upon the area and form of the immersed longitudinal-vertical section of the vessel.

The doubled-boarded boat as depicted in Fig. 14, affords peculiar advantages for lengthening the arm of the turning couple, as by lifting the board (*h*) the centre of lateral resistance is thrown very much forward, and the area of dead wood at the after end (which might be necessary in a sailing vessel to check leeway or to balance sails) is considerably reduced. In tacking, if the vessel's "way" were stopped as she came head to wind, and the rudder thereby became useless, the fore board *a* could be raised and the after board lowered, and thus the head of the vessel, by aid of the fore sails, would readily fall off the wind.

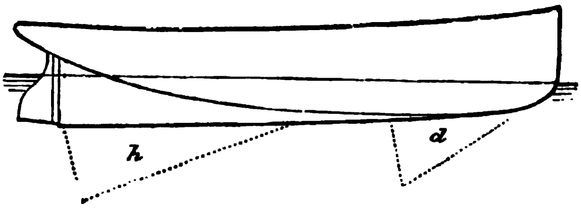

FIG. 14.

All kinds of fanciful forms have been given to rudders, and a practice came in a few years ago of putting the greatest breadth near the surface of the water. We believe this practice was owing to a vessel once having the lower half of her rudder accidently carried away, and the subsequent report that she steered better with the part than with the whole. We are inclined to think that in this case the inefficiency of the entire rudder depended on its being too big for the crew to use; at any rate, an experiment made by Mr. Froude with a model of H.M.S. Encounter clearly proved that the lower half of a rudder is more effective than the upper half. The rudder was in two parts, *i.e.*, squares of equal dimensions, and it was found that the upper half required to be put over to 20° to balance the lower half at 10°, in order that the vessel might follow a straight line. In the case of a very raking sternpost there may be a small advantage in having the broadest part of the rudder in the top half, as its centre of effort would thereby be carried farther aft; but generally there can be no doubt that the deeper the main area of the rudder is immersed, the more effective it is. As a clean run aft is a great assistance to the effectiveness of the rudder, it is quite possible if an experiment similar to that tried on the Encounter were tried with a yacht, that a less difference in the effectiveness of the two halves might be found. The advantage of keeping the rudder well immersed—both in smooth and disturbed water—is so well understood by small boat sailers that we find many small and shallow craft with their rudders dropping considerably below the keel. The only disadvantage of this arrangement is that, if the boat carried much weather helm, and if the centre of effort of the rudder were much below the centre of lateral resistance, the pressure on the rudder would tend to increase the boat's heel, although not to a considerable extent. (These rudders are so hung that in shallow water they lift without unshipping.)

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* Centre-board yachts are frequently said to be more sluggish in stays than keel yachts, and no doubt there is some truth in this, although, looking to their immersed form alone, they ought undoubtedly to turn quicker than keel yachts. In the races between the Cambria and the centre-board yachts in America in 1870, it was repeatedly shown that she was quicker in stays than any of her competitors, but we are inclined to think that the superiority in this respect was to some extent due to her greater weight (compared with the linear dimensions), so that she carried her way until well round on the other tack. If two vessels are to be impelled by an equal force at equal speeds, and one vessel is heavier than the other, then it will take a greater time to get the heavier vessel up to the required speed than it would the lighter vessel; so also when the force is withdrawn it will take a greater time to exhaust the momentum due to the speed of the heavier vessel than it would the momentum of the lighter vessel. Thus heavy vessels are always said to "shoot" far in stays, and fill on the other tack without losing way. However, the advantages which a heavy vessel has in this respect will be mostly apparent in strong winds when the momentum due to high speeds is very great.

There appears to be no definite rule for determining the breadth of rudders in sailing yachts, but generally we find the breadth to be one-twentieth of the length on the load line, and about one-thirtieth of that length in steam yachts. With regard to the efficiency of broad and narrow rudders, it would appear, from experiments made for the Admiralty some years ago, that a rudder of, say, 3ft. in breadth, put over to an angle of 30°, would have double the efficiency or turning power of one 6ft. in breadth put over to half the angle, or 15°; and the force required to move the rudder would be the same in either case. Thus there can be no increase in the efficiency of a rudder by the mere addition of breadth without an increase in the power to use it, and a very large rudder, if used to get its greatest efficiency—which is found to be when put over to an angle of about 35°—means a great retardation of speed; or, the smaller the circle a vessel is made to turn in, the more speed will be retarded. So far as small steam yachts are concerned, no rudder offers greater advantage for facility in using it and efficiency than Gumpel's, as, owing to its construction, it does not take an equal force on the tiller to balance the water pressure on the rudder. (This rudder was fully described in *The Field* of June 20, 1874, and Oct. 23, 1875.) A variety of steering gear has from time to time been introduced, which, by the aid of a wheel, has enabled one man to do the work of two or three. Of these contrivances none promise better results than that of Mr. G. L. Watson; but, so far as racing yachts are concerned, we think a long tiller and relieving tackle must be relied upon.

All other things being equal, the diameter of the circles vessels will make in turning is in direct ratio to their dimensions. Thus, take two yachts, one of 25 tons and the other 200 tons: their length would be 50ft. and 100ft., and the yacht of 50ft. should in turning describe a circle of just half the diameter of the one 100ft. long. The latter will describe a circle in turning of about twice her own length, or 200ft. in diameter (assuming her to be under steam power, with her helm over to 35°), at a speed of eight knots in about two minutes, as the direct speed would be retarded nearly two thirds. Under sail, however, and in getting from one tack to the other, a yacht does not describe a circle, but only one-fourth, or the arc of a quadrant, if she lies four points from the wind; and presuming a yacht in tacking traversed the whole arc of a quadrant from the force of a direct speed of eight knots an hour, she would be a little under half a minute in getting from one tack to the other. Now, we know that a yacht of 100ft. long cannot get from one tack to the other in half a minute, nor does she describe exactly the arc of a quadrant. However, for the purpose of illustration, we can assume that a yacht maintains uniform speed whilst turning. In Fig. 15 A N D form a quadrant, and let E be a yacht proceeding in a direction parallel to B A D, with the wind blowing as shown by the arrow, four compass points or 45° from her course. The yacht when in the position F would be head to wind, and when at H would be on the other (port) tack, on a course at right angles to that at E. But the speed of the yacht would diminish from the time her helm was put down, and when she arrived at F, head to wind, her propelling power would be gone entirely. She would proceed a little farther on the arc of the quadrant under the influence of her rudder, but would eventually pay off, under the action of her head sails, and come fairly on the other tack (proceeding in a direction parallel to A N), somewhat in the direction K.

As a matter of fact, the portion of the circle which a yacht describes in tacking is always of greater radius than her own length, or the circle in diameter is greater than twice that length. The helm cannot (and frequently it would be inadvisable so to do) be put over to 35° suddenly in large yachts, and generally the yacht will be head to wind before the helm is so over to 35°. Thus in a large yacht, say of 100 tons, the helm cannot very well be put down too quickly, or indeed even quickly enough. On the other hand, in small vessels, the helm may be put over too suddenly, and, by forcing the yacht to describe a segment of a circle of very small radius, her way becomes deadened; so that, when she gets on the other tack, she rests motionless in irons, instead of springing off almost with way unchecked. This is a very important matter, as successful tacking

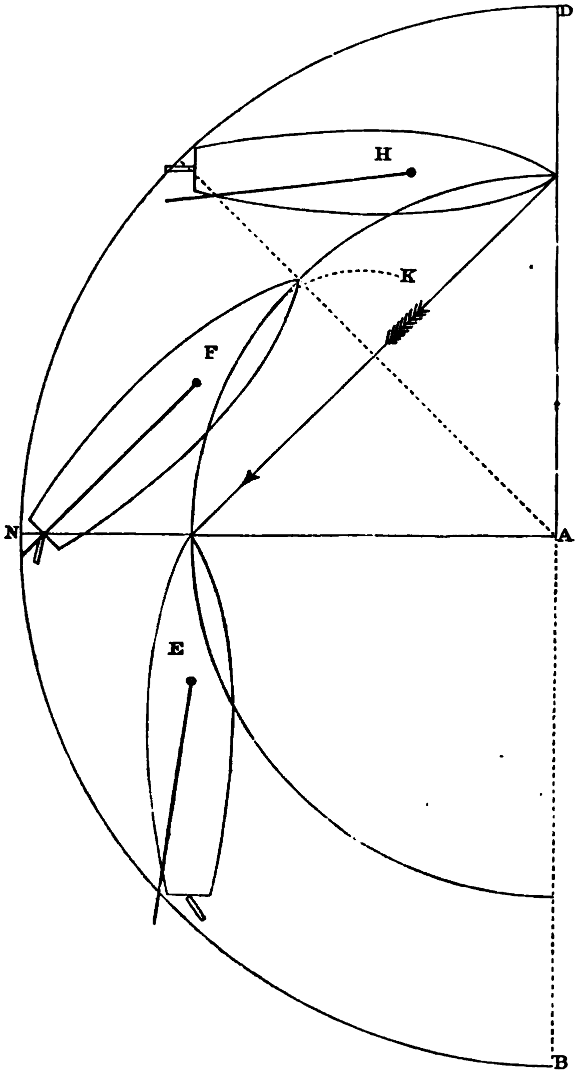

Fig. 15.

does not depend upon merely getting from one tack to the other, but in getting *off* on the other tack without losing way. The helmsman of a large craft cannot very well make a blunder, as generally the speed with which he can walk a tiller down to leeward is that most suitable for preserving continuous way in tacking. This is not the case in small vessels, as the tiller can be put over with one hand suddenly, and the vessel brought head to wind (when, of course, all her propelling power is gone) in from five to ten seconds. Now it is obvious that some turning power is required after a vessel is head to wind, as at that point she is only half-way towards getting on the other tack, and no help can be obtained from the rudder if there be no way on the vessel. Thus, if a vessel's way be stopped before she be fairly on the other tack, the head sails will have to be kept a-weather; but in smooth water at least, and in a whole-sail breeze, a skilful helmsman will never require such aid, but tack his vessel fairly by the influence of the rudder, the head sheets being lightened up of course. It should not be lost sight of that in performing the first half of the operation of tacking—that is; bringing a vessel head to wind—all the assistance given to the vessel by the sails in turning is of the very greatest value, as the turning action of the sails does not retard or deaden the vessel's way like the action of the rudder. By letting fly the head sheets, the centre of effort of the other sails would be thrown so far aft, that a very long arm would be formed by the couple C E *s* in Fig. 11. It is also quite possible to tack a vessel without putting the helm down at all, especially if she carries a fair amount of weather helm; upon letting go the tiller and jib sheet the vessel would fly head to wind and, the fore sheet being kept a-weather, her head would soon pay off, although it might be found necessary to ease the main sheet before she would gather way, as the foresail being aback would necessarily tend to put stern way on her. At the meeting of the Institution of Naval Architects in 1871 the late Sir E. Belcher, speaking on the handiness of sailing ships, stated that when he was in charge of the Samarang he gave a written order to the officers that the helm was never to be put down in tacking. The helm was let go, and the vessel came head to wind, the head yards were braced aback, and thus the Samarang was always got round. Possibly this was a smart thing to do, but there can be no doubt of the value of the rudder for quick staying, if used judiciously.

CHAPTER V.

SAIL-CARRYING POWER AND SPEED.

The success of a yacht in competitive sailing is no doubt largely dependent upon her power for carrying sail, and this "power" is represented by the statical stability of the vessel. The *Engineer*, in reviewing "Yacht Designing," said: "We are glad to find so much importance has been placed upon stability as to lay down as an axiom, in which we (the *Engineer*) most heartily concur, that nearly all the failures in yacht designing are traceable to the want of exact knowledge on the part of the designer of the laws by which the stability of floating bodies is governed; or that if these laws are understood, the means for quantitatively proving this operation in sailing yachts have not been exercised." In Chapter I. an attempt was made to explain, as simply as possible, the laws which govern stability; but the mode of calculating its exact value for any particular model would involve a labour much beyond our present purpose. It was explained by Fig. 6 that the righting moment or energy of a vessel to recover her equilibrium, after being heeled to any angle, was represented by the length of her righting lever x G (corresponding to the angle of heel) by the weight of the vessel. It is thus obvious if a vessel has so much energy to regain her equilibrium after being heeled, that an equal energy must have been employed in heeling her from that position of equilibrium. In the case of a sailing yacht that energy is represented by a force of wind blowing upon the sails, and exerted collectively through the centre of effort on a coupling lever, the arm of which is the distance the centre of effort is above the centre of lateral pressure or centre of lateral resistance. In Fig. 11 this arm is represented by the distance C E q. To fully explain how the sail moment must equal the righting moment to keep a vessel at any angle of heel, it will be necessary to employ a few figures, abstracted from "Yacht

Designing" concerning the well-known racing cutter Kriemhilda. (We select that vessel because she is one of the few whose exact stability has been proved.) The area of the Kriemhilda's sails (including topsail) is 5622 square feet, and the centre of effort is 46ft., above the centre of lateral resistance. The moment of these sails will be $5622 \times 46 \cdot 5 = 261423$; and, presuming the wind pressure to be equal to 1lb. per square foot, the heeling moment of the sails would be 261,423 foot-pounds. The righting moment in foot-pounds of Kriemhilda must next be arrived at. Her displacement is 115 tons, which, reduced to pounds, is 257,600lb.; at 16° inclination Kriemhilda's righting lever is 1 ft. long, so that for that angle of heel her righting moment would be 257,600 foot-pounds, or nearly equal to the heeling moment of the sails.

Generally, in speaking of the "stiffness" of a yacht, the term is only used in a relative sense, and, if a vessel is said to be not very stiff, nothing more is meant than that she is not so stiff as some other vessels under a similar area of canvas and wind pressure; that she is in any *danger* through not being very stiff is a contingency never dreamt of. Now, so far as most English yachts of the deep V type are concerned, it may be said that they are absolutely uncapsizable; but it is not so with regard to many shallow yachts and boats of this country and America. The relative safety or danger of the two different types of vessel can best be illustrated as a curve of stability as shown by Fig. 16.

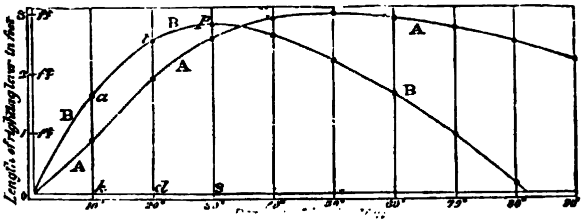

FIG. 16.

The distances *a k*, *t d*, *p s*, represent the length of the righting lever (see *x* G, Fig. 6) of a vessel, heeled respectively to 10°, 20°, 30°, &c.; then the curved line B passing through the spots at the termination of the distances (as at *a*, *t*, *p*, &c.) is the "curve of stability." The curve A represents the curve of stability of an English yacht of the deep type, and it will be seen that the righting lever is longest when the vessel is heeled to 50°, where it is 3ft. long; this would be termed the vessel's maximum stability. The curve B represents the curve of stability of a vessel of equal length, but of greater beam, and much less depth and weight. It will be seen that this vessel has the greatest length of righting lever at 30°

inclination, where, like the other, it is nearly 3ft. long; this is the shallow vessel's maximum stability.

From 0° up to 30° it will be seen that the shallow vessel has much the longer length of righting lever; but it is quite possible that the deeper vessel would have as much actual righting power as she would have a *greater weight* acting on the lever; but, assuming the weight, or displacement, of the two vessels to be equal, the shallow one would have the greatest righting power up to 30°, when some portion of the deck would be immersed.

Now, it is this greater stiffness at initial angles of heel which, whilst it is of the utmost advantage for speed, forms the element of danger in shallow vessels. It can be supposed that a vessel, B, is sailing at an angle of 15°, and that a sudden acceleration of wind force heeled her to 30°, the point where her maximum stability would be reached; then, if the wind force were not instantly removed the vessel would increase her heel if she got the least beyond the 30° until she finally lost all stability, or righting power, at 80° and capsized. But if a similar force were applied to a vessel with a curve of stability like A, when she reached 30° inclination there she would stick, and it would take a very large increase of wind to carry her to 50°, the point where her maximum stability would be reached; and even then there need be little danger of capsizing, as the decrease in the length of the righting lever is so slow, that at 90° there is nearly as much righting power as the shallow boat has at 30°. (As a matter of fact, no wind force could lay a yacht, with such a curve of stability as represented by A, flat on her beam ends, inasmuch as long before she reached 90° the wind would have lost nearly all its effect upon the sails.*) The curve B, no doubt, very accurately represents the curve of stability of such a vessel as the American yacht Mohawk, which was blown over during a squall off Staten Island last summer. The vessel was at anchor, and, no doubt, from this cause felt the force of the squall more severely. Her maximum stability

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* A correspondent, under the signature of "Trial," made the following remarks upon this statement:

"This supposes the wind to be always horizontal in its direction. But, I believe, it is now a recognised truth in meteorology that the wind sometimes blows in what are termed 'vertical currents,' which strike upward or downward at an angle which varies according to circumstances. Of the existence of these vertical currents we have familiar evidence in the manner in which fragments of straw and other light articles are often lifted up into the air, and in which smoke is blown into the streets of a town from the chimneys of houses, and down to the surface of the sea from the funnels of steam vessels. Any unusual prevalence of vertical currents appears to indicate the approach of either rain or storm.

"It appears evident that no angle of inclination could with certainty save a vessel from the danger of receiving the full weight of the wind coming thus at right angles to the the plane of her canvas.

"The great danger to a yacht of the first-class English build would be damage to sails, spars, would be reached, say at 30°, and then the squall that put her over so far would take her to the vanishing point in less time than it takes to write it. But it is quite possible that the Mohawk would not have gone clean over on her beam ends if her ballast and heavy cabin furniture had not shifted, inasmuch as when she got to 60° the wind must have had decreased effect on the sails; and, as the squall passed over very quickly, the Mohawk might have righted but for the reason stated. However, beyond the accident of the ballast and heavy furniture shifting, the Mohawk was subject to another condition, which rendered her righting quite impossible: she had a very large "well" or cockpit aft, into which the main cabin opened, and soon after the deck became immersed the water rushed into the cabin, and then, of course, her chance of righting was gone. Now, from the manner of stowing the ballast in a deep yacht, there would be little chance of its shifting until the vessel got beyond her beam ends, when it might certainly come tumbling through the skylights. However, deep yachts, such as the Vanessa, Kriemhilda, Seabelle, or other similar yachts, are in no danger, even if hove down on their beam ends, providing water is not allowed to get inside their hulls. The case, however, is very different with shallow vessels and with some steamers, which have their centres of gravity high; and it is necessary for their safety that they should never be sailed very near the angle of heel where their maximum stability is reached. In practice, in small shallow boats, this is well understood, and the helmsman throws his little craft in the wind directly she is struck by a squall, or lets go sheet or halyards, whichever comes readiest to hand.

The stability of stiffness of a yacht under canvas will principally interest English yachtsmen as a matter affecting speed; and every novice knows that the more canvas a boat will carry at any given angle of keel, the faster she will be, all other things being equal. To demonstrate that power to carry canvas affects speed, it will be convenient to take two vessels of very opposite types, such as the American centre-board schooner Columbia and the English schooner Seabelle. The linear dimensions of the Columbia are 98ft. on the load line, and 25·7ft. beam; her displacement is 150 tons, and her area of lower sail 8770

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and rigging, because the force of the wind itself must be checked and its direction turned when it strikes the sea; and, as a yacht of that character retains a substantial 'righting' power even at the angle of 90°, she ought to recover herself even if thrown on her beam ends, provided she escapes the danger of taking in water to a dangerous extent by skylights and hatches.

"What would become of the crew on deck I presume not to determine.

"It seems quite clear that a vessel of the broad, shallow style, so much in favour in America, would be exposed to far more serious danger, although up to the angle of 30° her stability might be superior to that of the English vessel."

square feet. The Seabelle is 90·5ft. on load line, beam 19ft., displacement 155 tons, and area of lower sails 5780 square feet.

The displacement of these two vessels is practically the same, but the sail area of Seabelle is less than two-thirds that of Columbia, or, in other words, the sail area of Columbia is 66 per cent. the greater. We have been witness that the Columbia has made 12·5 miles per hour in a lower-sail breeze blowing a little abaft the beam, the wind pressure being equal to 2lb. per square foot. Seabelle under similar conditions has made 11·4 knots per hour. At a speed of 12½ knots the resistance met with by Columbia would probably be increasing as the fourth power of the speed, and if her sail area were reduced to an equality with Seabelle's, her speed would be reduced in the ratio of $\sqrt[4]{\frac{2}{3}}$ or about $\frac{1}{1{\cdot}15}$; or to about equality with Seabelle's speed.

If these two yachts set out to sail a course of 50 miles with a strong leading wind, the Columbia would accomplish the distance in four hours, and the Seabelle in four hours twenty-three minutes. Now here are two vessels of exactly the same displacement; but one, by adding nearly 37 per cent. to her beam, and only 8 per cent. to her length, is enabled to carry nearly 70 per cent more canvas; and it is quite fair to assume that the advantage gained by the Columbia is mainly due to her greater area of canvas, and not to any superiority of model. That is to say, if two designers of yachts are given a displacement of 150 tons to work upon, and one produces a vessel that will carry 70 per cent. more canvas than the other, it is quite evident that the vessel with the larger area of canvas should be very much the faster, as it is unlikely that her designer would allow her to suffer from defective modelling of entrance and run. [As a matter of curiosity, we might here state that the measurement for competitive sailing under the rules of the New York Yacht Club is one of displacement, and if Seabelle and Columbia set out to compete under these rules, they would be rated upon equal terms, or rather Seabelle would have to give a few seconds time. We need not stop to inquire whether this would be an equitable arrangement, but it can be assumed that English yachtsmen consider the advantages which are due to length and beam are fairly taxable, as both these quantities are terms in the Y.R.A. measurement formula. By this formula Columbia would be rated as of 264 tons, and Seabelle 140, and the time allowance would be 16 minutes for a course of 50 miles.]

It has been sufficiently shown that sail-carrying power is a very large factor in the elements which make up a vessel's success in competitive sailing; and generally, as that power cannot be increased by adding to beam and length without such additions being adequately taxed, the designer exercises his ingenuity in depth and ballasting. Thus, if we find two vessels of equal length and breadth, and one exhibits an advantage over the other, that advantage will be nearly always traceable to greater sail-carrying power. The conditions upon which this power is dependent have already been explained, and the importance of well considering them need not be further dwelt upon.

CHAPTER VI.

RESISTANCE AND SPEED, AND THE INFLUENCE OF THAMES MEASUREMENT.

IT has been assumed, in the last chapter, that the attributes of the two yachts as to form, upon which their resistance to motion depended, were equal, although one had a much greater propulsive force than the other. Of course this need not be so, and in fact, at very high speeds, the resistance, due to form and other qualities, might vary very considerably; and consequently the speed might vary independently of relative sail-carrying efficiency. According to recent investigations there are only two principal sources of resistance, and they are consequent upon surface friction and wave-making. "Surface-friction" is due to the adhesion of the water to the immersed surface of the hull, and from the experiments made by Mr. Froude for the Admiralty, we learn that up to the period of wave-making the *whole* appreciable resistance is caused by surface friction alone; thus at low velocities any form, not having an absolutely flat or blunt end, would only have surface friction to contend with. A fairly modelled yacht of, say 50ft. in length, moved at a velocity of five knots an hour, need make scarcely any waves, and the resistance she would encounter would be almost entirely due to the friction of the water on the surface of her copper. From the foregoing it can be gathered that, so far as the resistance due to surface friction is concerned, it will be advantageous for a yacht to have a comparatively small area of surface immersed, and for that surface to be of the most uniformly perfect smoothness. The friction resistance of perfectly clean copper (with no nail heads or other uneven protrusions), upon a vessel 50ft. long, is equal to 0·246lb. per square foot at a speed of six knots per hour; and the resistance increases uniformly as the 1·83 power of the speed. But if the vessel be coated with fine sand, the resistance is equal to 0·405lb. per square foot, and increases as the 2·06 power of the speed. For medium sand, such as may be met with on the shore, the resistance is as much as 0·488 per square foot, and the resistance increases as the 2·2 power of the speed. The advantage of having a perfectly clean and smooth surface is therefore paramount, and the advantage will be most marked when sailing in light winds, which of course means low velocities.

The form of vessel which yields the least surface for friction for any fixed displacement is one of round full lines; but full lines are incompatible with high speeds, as the wave-making resistance then assumes enormous proportions. That form which most nearly accords with the wave-line theory is the one which can be made to move at the highest velocities without any very sensible wave-making; and it should be always remembered that directly wave-making commences, the resistance no longer increases at about the square of the speed, but very rapidly ascends, and may reach even as high as the 6th power of the speed.

For the sake of great internal accommodation, it is considered an advantage to have a considerable parallel length of middle body, or, as shipwrights call it, "straight of breadth." Mr. Froude has recently made some experiments in this direction with a view of determining how far a perfectly straight piece of middle inserted between two good ends affects resistance. The results of his experiments were communicated to the Institution of Naval Architects in March, 1877, and are most interesting. So long as a moderate speed, not exceeding 12 knots with a ship 160ft. long, was maintained, the insertion of 40ft. of middle body affected the speed in almost a direct ratio to the increased surface; but at higher speeds the resistance increased in a greater ratio, and presented some peculiarities.

At the higher speeds a succession of waves followed the bow wave along the side of the ship, and if the crest of the last of these waves came at about the middle of the length of the after body, the forward pressure on this part of the ship was increased, and there was a consequent decrease in the total resistance; but when the speed was so altered that there was a hollow in place of the crest in the position indicated, there was a decided increase in the total resistance. It would therefore appear that increasing a vessel's length by making an addition to the middle body need not necessarily be accompanied by a favourable diminution of wave-making. The Guinevere is the best example we know of as a yacht with a great straight of breadth, although of course she has no parallel side, such as could strictly be termed so. The inference is that if 20ft. (equal to about 70 tons displacement) were taken out of Guinevere, her resistance, say at speeds of about 9 knots per hour, would be slightly diminished. At the speeds where wave-making would be very sensibly felt, the case would be different, and greater might advantage be gained; but the fact that the sail-carrying power had been considerably reduced by the abstraction of 70 tons displacement would have to be weighed against this.

This leads to another important consideration, for it must be remembered that we are dealing with sailing vessels, and not with vessels propelled by steam. Under the present rule for classing yachts for competitive sailing, beam is heavily taxed, as stated in page 39; and this effectually prevents a designer making a large use of beam to obtain great sail-carrying power. Accordingly, as beam can only be used in a restricted way, great employment is made of weight or displacement. A "long body" is given by making the fore-and-aft lines as straight and full as may be considered consistent with the expected speed, and the depth and sharpness of the body are only limited by the same considerations;* but it seems pretty certain that better results could be obtained, so far at least as speed is concerned, for any given length and weight of vessel, if beam were left entirely unrestricted.

It was shown in the last chapter that, with a given displacement, an excess of beam is an enormous advantage for effective sail-carrying power; and, according to some experiments made by Mr. Froude, and recorded by Mr. W. H. White in his valuable work on "Naval Architecture,"† an increase of beam may result in a decrease of resistance. In designing two river gun boats for the Royal Navy of 110ft. length, and 6ft. draught of water, the question arose as to whether it would be more advantageous for speed to give them a breadth of 34ft. instead of 26ft. Experiments were made, and the result was clearly pronounced in favour of the greater beam.

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[*] It is generally supposed, and we have frequently seen it stated in print, that a body moving in water meets with resistance in proportion to the depth of its immersion. Mr. Froude, however, in his reports on resistance clearly shows that relative depth of immersion has little or nothing to do with the resistance of bodies moving in fluids. In reference to this subject, Mr. W. H. White, in his recently published work on "Naval Architecture" says: "If the plane were immersed very deeply, it would create little or no surface disturbance, and therefore require less force to propel it at a certain speed, than would a plane of equal immersed area moving at the surface with a portion situated above that surface. This statement is directly opposed to the opinion frequently entertained, which confuses the greater *hydrostatical* pressure on the plane, due to its deeper immersion, with the dynamical conditions incidental to motion. If the deeply immersed plane were at rest at any depth, the pressures on its front and back surfaces would clearly balance one another. When it is moved ahead at a uniform speed it has at each instant to impart a certain amount of motion to the water disturbed by its passage; but the momentum thus produced is not influenced by the hydrostatical pressures on the plane, corresponding to its depth of immersion. Water is practically incompressible: apart from surface disturbance, the quantity of water, and therefore the weight, set in motion by the plane will be nearly constant for all depths, at any assigned speed. In other words, if there were no surface disturbance, the resistance at any speed would be independent of the depth."

[†] See the "Manual of Naval Architecture," by Mr. W. H. White, page 461.

The broader vessel had practically no straight of breadth, or great length of middle body; and she thus obtained a longer entrance and longer run, with a greater area of midship section. The displacement of the broader vessel was 370 tons, and that of the narrower 350 tons. The resistance of the broader boat at a speed of nine knots was only two-thirds that of the other, and this great advantage was mainly due to lesser wave making. Whether in the case of vessels propelled by sails the advantage would be maintained by good performance in a strong wind and disturbed sea is perhaps open to doubt, as there is no question that a long body with any given length and weight has some advantages over a short body in a sea. Still there equally can be no question that vessels like the Guinevere and Seabelle would have an accession of good qualities by a moderate increase to their beam, even though such increase were attended with additional displacement.

The lines of the famous cutters, Kriemhilda and Vol-au-vent, in a certain degree, form a notable illustration of the use of length of body for a sailing vessel under some circumstances. The Kriemhilda is remarkable for her long body, and comparatively full entrance and run. The Vol-au-vent, of equal displacement, length, breadth, and depth, has a greater area of midship section, and her ends are finer; in fact she has a shorter and fuller middle body. So far as the evidence of the performances of these two vessels go, there is not much doubt that for high speed in smooth water the Vol-au-vent has some advantage; but in a much more marked degree the advantage rests with the Kriemhilda when sailing in a disturbed sea. If the Vol-au-vent had been given a little more beam, she would, in all probability, have exceeded the performances of Kriemhilda on all points of sailing, and under all conditions; but an addition of 1ft. to Vol-au-vent's beam would, under the present tonnage rule, have put a penalty of 12 tons upon her for competitive sailing, and no doubt the penalty would justly value the effect of the additional beam. Thus far the rule apparently operates with the strictest precision; but it is only fair to state that, if the rule took no cognisance of beam, both Vol-au-vent and Kriemhilda would probably have been given a foot more beam, and both would have been the better for it.

No doubt the difficulty in the way of successfully making any experiments with beam in the direction indicated is the Thames rule of measurement adopted by the Y.R.A. The penalty put upon beam, and the absence of any restriction upon depth or ballasting, have left, for the purposes of competitive sailing, no opportunity for the naval architect to profit largely by the results of recent investigations of the laws of resistance. His ingenuity, consequently, is almost wholly directed to the question of stability as dependent upon depth and ballasting. This condition has been very seriously deprecated; but it is some satisfaction to know that the Thames rule has encouraged a type of vessels that, for sea-going qualities, cannot probably be surpassed. The practical operation of the rule has been to produce a type of vessel which, although incapable of developing the highest speed under favourable circumstances for such, is for general accommodation and comfort, and good behaviour in a sea, excellent; and no other rule yet proposed has promised to develop such sterling qualities. As a means of comparing the speed or qualities of yachts for competitive sailing, the Thames rule is necessarily a just one, as all the yachts sailing under it are of one type; but it is contended that the rule, by virtue of the penalty it places on beam, is not just in its operation upon yachts when the ratio of beam to length greatly varies. There is some truth in this; but, whilst realising the unjustness of the penalty placed upon beam, we must not lose sight of the dangers which would surround its removal.

The measurement most generally urged as the best to replace the Thames rule is that of displacement; but it cannot be contended that displacement of itself would afford any means of calculating the relative capabilities of different yachts. This was clearly shown in the last chapter, and the inference is that, if displacement were made the standard of value for competitive sailing, yachts would be built shallow and broad, in order that a great sail area might be carried upon a small displacement. It has been suggested that this tendency of the rule could be checked by making the displacement bear a certain minimum proportion to the length, breadth, and depth, or, in other words, that there should be a limit to the coefficient of fineness; but any limitation in this way, if otherwise unobjectionable, would not realise the desired object, as the proportion of displacement to the length, breadth, and depth would, under any circumstances, be pretty much the same in either a deep or shallow yacht.

The broad and shallow yacht would carry the largest amount of canvas, and so would have the greatest speed. As speed is the desideratum in racing yachts, it is right that a designer should be left entirely uncontrolled in developing that quality for a certain value—say the displacement. This appears to be reasonable enough, and would be entirely unobjectionable if no other qualities were sought in a yacht than those of mere speed. But, as yacht racing is not so much the aim of yachtsmen as cruising, they very properly look with great suspicion upon any innovation that would be likely to introduce a yacht deficient in the sterling qualities that the present type are known to have. To forcibly illustrate the nature of the deficiences that might be expected in yachts if displacement became the standard of value for yacht racing, we can take the case of the Seabelle and Columbia. The internal (available) capacity of the two yachts is about equal, but the expense of working the Columbia would be at least 50 per cent. greater than the expense of working the Seabelle. A yacht like the Columbia would be an indifferent sea boat, and her great spars and sail area, that would be of such importance for smooth-water sailing, would be only a dangerous incumbrance in a sea;* further, there is the positive danger that such a yacht might capsize if unskilfully handled. These deficiencies are quite sufficient to horrify any English yachtsman; and supposing that displacement became the basis for time allowance in competitive sailing, the only advantage of a Columbia would be that she would win prizes if matched against yachts of the Seabelle type. Thus, whilst we are fully alive to the objections to the Y.R.A. rule, we are entirely opposed to the proposal, most generally advocated, to change it for that of displacement: for the reason that, whilst the Y.R.A. rule places some check upon the full development of speed, it induces good sea-going qualities; whereas a measurement by displacement, whilst admitting unrestricted development of speed, would induce very bad sea-going qualities.

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* On Oct. 18, 1871, the English yacht Livonia and American yacht Columbia sailed a match in New York Bay. They started in a fine whole sail breeze, which during the match much increased. The Columbia found it prudent to take in topsails and *stow* her *foresail*. The Livonia started nothing but her balloon maintopsail. In America a measurement of displacement and other causes (mostly of a local character, limiting draught of water) have induced a beamy, shallow type of vessel, undeniably fast and weatherly in moderate winds but generally ill-adapted for such cruising as English yachts undertake. That the shortcomings of the English yachts Cambria and Livonia, in their contests for the American Cup, were to some extent attributable to their deficient sail areas compared with those of their antagonists. In the club races no booming out or square sails were allowed, and the Cambria and Livonia were invariably beaten by the centre-board yachts before the wind; in the "scrub" races (sweepstakes got up independently of the club) booming out and any description of sail were allowed; the American yachts had none but their fore and aft sails to boom out, and the Cambria had square sails and the Livonia spinnaker; the result was that they could more than hold their own "down wind" when in these scrub races.

CHAPTER VII.

BALLAST.

The displacement of a vessel is a quantity which enters very largely into any consideration of her stability, as was abundantly shown in a former chapter, and in no way does the knowledge of a yacht's displacement more largely assist the naval architect in his labours than in the matter of ballast. Most English yachts are built of pretty much the same scantling, and have similar internal fittings and spars; yet the weight, exclusive of ballast, of any two yachts of equal length and breadth may vary considerably, as will be gleaned from the following table, abstracted from "Yacht Designing":

Name of Yacht.	Weight of Ballast in Tons.	Ratio of Ballast to Displacement.	Displacement in Tons.	Tonnage Y.R.A. Rule.
Sappho	80	·345	232	376
Guinevere	112	·377	297	294
Gwendolin	90	·445	202	192
Cambria	65	·389	167	193
Aline	70	·368	190	207
Seabelle	73	·471	155	140
Egeria	60	·422	142	152
Livonia	70	·325	215	264
Florinda	52	·361	144	136
Kriemhilda	52	·452	115	106
Vol-au-vent	54	·450	120	104
Fiona	50	·463	108	79
Iona	35	·486	72	66
Myosotis	26·5	·541	49	40
Bloodhound	26·5	·564	47	40
Vanessa	16·5	·579	28·5	20
Lily	6·75	·523	12·9	10
Pastime	8·44	·538	15·6	10
Kohinoor	8	·544	14·7	10

It is very evident that, the greater quantity of ballast a vessel has in proportion to her displacement, the lower ought to be her centre of gravity, and, as a sequence, the greater ought to be her stability. A yacht builder, therefore, even if he disregards the simple calculation of the displacement of a vessel he is commissioned to construct, will know that, so far as sail-carrying power is concerned, an advantage must accrue from making the fabric of the hull as light as possible, consistent with security, if the vessel be intended for racing.

But, as already pointed out, it must not be concluded that of two vessels of equal length, breadth, and draught of water, and equal scantling so far as sizes of timbers, beams, and planking go, the weight of the hull need be the same. The probability is that the vessel of the larger displacement will carry the greater proportionate weight of ballast, as is very pointedly exemplified in the case of the Sappho and Guinevere. Now the Sappho is a much lighter-built boat than Guinevere; yet, in proportion to displacement, it will be seen that she carries a smaller quantity of ballast. The reason of this is dependent upon the different forms taken by the vertical sections in the two vessels. The Guinevere's midship section is of the peg-top form, and the greatest girth of the midship frame, from the load line to the keel, is 16ft.; the Sappho has a section very flat from the bilge to the garboard, and then very curved. The consequence is that the girth or length of the frame, from the load line to the keel, is nearly 20ft.; and there will be a proportionate excess of length in nearly every frame. For this reason, unless vessels of similar linear dimensions be also of similar form, they need not have the same ratio of ballast to displacement. It will be noticed in the table that as the size of the yachts decrease the ratio of ballast to displacement increases; the cause of this is that depth in a small yacht is relatively greater than in a large one—or, in other words the depth is not made to decrease in proportion to the decrease in the other two dimensions of length and breadth.

A very great change has been wrought in the manner of ballasting yachts during the last quarter of a century, and we cannot help declaring that generally a better type of vessel has been built since ballasting has received greater attention. Scrap iron, fire bars, and even stone, were the common form of ballast in the first days of the Squadron, with a few shot bags to trim to windward in the event of match sailing. We all know that, as the pastime of yachting developed, a taste for yacht racing was very rapidly disseminated, and ballast shifting came to be regarded as part of the science of the sport; and thus success, in fair sailing breezes, frequently rewarded the man who had the greatest weight of shot bags, and the greatest number of men to shift them. There is no denying that the absence of restrictions upon the shifting of ballast was introducing us to a very bad type of vessel, and the thanks of the present generation are due to the men who some twenty years ago "sat upon" the practice of trimming ballast to windward. In all competitive sailing it was made a point of honour with yacht owners that they would not permit ballast shifting during a race; and now a man who is convicted of a breach of the rule is—or rather would be, as no breaches of the rule are brought to light—regarded as a little worse than a thief, and would certainly be ostracised by every club in the kingdom. There certainly is nothing heinous in the mere act of shifting ballast; but when the non-doing of it is made an affair of honour, it follows that dishonour must attend a breach of the rules.

When the prohibition of shifting ballast came into operation, it was only reasonable that yachtsmen and yacht builders should devise some plan to enable the yachts to continue to carry the enormous spars and sail areas that shifting ballast had called into existence. The shot bags that had been shifted from bilge to bilge were permanently located in a solid form in the bottom of the hull, and metal keels—generally of iron—became fashionable. Then lead keels were timorously introduced; but the man who owned a yacht that would not stand up without a lead keel was regarded with a feeling which was a mixture of contempt and pity. Indeed, lead ballast generally was contemned, and when a vessel appeared with "all lead ballast" the prophets were loud in their predictions that she would "get caught some day, and sink like a stone." This comical prediction, so far as we know, has not been verified, and "all lead" for racing vessels is now the general practice. There seems to be no limit to the proportion of ballast to be carried outside, and, whilst the general practice during the last three or four years has been to put about one fourth of the ballast outside, on the keel or in the garboards, we have seen as much as four-fifths of the total ballast put outside some 10 and 5 tonners. Generally we agree that the employment of a lead keel has advantages; and probably the practical failure of one or two attempts which have been made to balance a bad type of vessel—built to evade the effects of a tonnage rule—by the aid of weights stowed very low, will check any evil influence the unlimited employment of lead as ballast might be supposed to have.

In some remarks on ballast, in "Yacht Designing," the following occurs: "The principal advantage of using lead as ballast is that, owing to its greater specific gravity or smaller bulk for any given weight, it can be stowed as a whole in a lower position in the hull than a similar weight of iron, and thus bring about a lower position of the centre of gravity of the vessel, which simply means that, with any given weight, greater stability can be acquired by using lead as ballast than by using iron. Next, as the centre of gravity of a vessel can be brought so much under command by the use of lead and lead keels, advantage has been taken of this to decrease the displacement for any given linear dimensions, and thereby increased fineness of lines has been obtainable. In this respect the employment of lead as ballast has had a beneficial effect. It has enabled naval architects to design vessels equal in accommodation to those of much greater cubical contents, that necessarily had to provide a large space for ballast, and at the same time to nearly equal in initial stability and speed the broad shallow vessels which are deficient in internal accommodation."

In order to get the centre of gravity of the ballast as low as possible, the practice is, so far as racing yachts are concerned, to distribute the weights in a fore-and-aft direction; and in order that as much weight as possible can be got into a metal keel, the latter is frequently made to reach the whole length of the vessel. So far as smooth-water sailing is concerned, nothing but clear gain will result from having the weights well distributed in a fore-and-aft direction; but the case will be different among waves, no matter whether the ballast be lead, iron, quicksilver, or pumice stone. The longer the radius of gyration and metacentric height are made, the more violent will be the pitching and scending motions among waves, and the vessel will dive, and be very wet and uneasy. But, on the other hand, if the weights are much concentrated, the vessel, whilst losing the momentum that caused her to plunge into a wave or "dive," will be extremely lively, and probably rise to every wave crest, large or small. The vessel with the longer radius of gyration will not so accord with the waves; and, although she may be "carrying her canvas better," yet will she so bury herself, that to sail her must be a work of great difficulty and danger, In moderate weather, and among comparatively small waves, the case might be somewhat different, as the momentum acquired would be unimportant, and the fore-and-aft motions of a vessel with a long radius of gyration would consequently be slow; whereas, a vessel with her weights much concentrated would tend to keep time with the waves, or would be what is termed "lively." This is particularly noticeable in little boats, and often among *small* waves better results are obtained by stowing the weights well fore-and-aft. As a general rule, the best place for the ballast is in the middle third of the length of the vessel; and if one third, more or less, of the ballast takes the form of a lead keel, the latter should not be greater in length than four-sixths of the length of the vessel on the load water-line.

Various ingenious methods of ballasting have from time to time been adopted or proposed, and we have seen it suggested that ballast should be slung, or that it should have elastic bearings. It need scarcely be pointed out that moving-ballast among waves would be a very bad thing, as the momentum acquired by the ballast would in effect augment the general momentum of the vessel; and further, if the ballast were "slung," it would shift to leeward upon the vessel being heeled by a wind force, and would be in effect like trimming ballast to leeward instead of to windward. The most ingenious and elaborate plan yet adopted in the way of ballasting is that introduced by Messrs. Harvey and Pryer; it consists of lead floors with angle iron inserted, lead keelson, with lumps of lead between the floors moulded to fill the spaces, and lead outside keel. This plan was very successfully tried in the Seabelle; she is wonderfully stiff, and is said to be easy among waves; at any rate, she has on two or three occasions done so well against a heavy head sea that there cannot be a doubt on this point, and it may be concluded that her ballast plan has had no detrimental effect upon her qualities as a sea boat.*

So far as small vessels are concerned, it is unusual now to have regular floors and keelson, for two reasons: firstly, because it is almost impossible to get grown floors for sharp bottomed small vessels; and, secondly, because they and the keelson occupy a space which is much better filled by ballast. The keel, in "siding" or breadth, of a ten-tonner is about double what it was before the era of lead keels, and this great breadth is resorted to partly that a heavy lead keel may be carried, and partly that the strength lost by the absence of floors and keelson may be compensated for.

The upper edges of the wood keel between the frames are sometimes cut away, in order to give additional space for ballast; in fact, every care is taken that all the crevices are filled, and that the ballast is stowed as closely, or as much like a solid mass, as possible. Some ten years ago a plan was introduced of running about half the ballast into the vessel hot; and certainly this plan so far fulfilled its object, that the ballast was solid, and all the small spaces were filled. But the plan was objected to for the reason that if anything went wrong with the frame of the vessel, or if the ballast required shifting, it was such a very great labour to cut the solid mass out. The best plan is to have two-thirds of the ballast cast from moulds, in blocks of from 2cwt. to 4cwt., as may be convenient, and the remainder in ingots, square and triangular in shape, of 1cwt. and ½cwt. each. Some loose ballast will always be required to trim the vessel in a fore-and-aft direction, and the large blocks, whilst they are difficult and dangerous to move, cannot be "stowed" if shifted from the places they were moulded to fill.

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* See a plate of Seabelle's Ballast Plan in "Yacht Designing."

CHAPTER VIII.

SPARS.

A GREAT many arbitrary and empirical rules have been from time to time proposed for the placing of masts in yachts, and for regulating their lengths; but, as there appears to be an inability to base these rules upon the stability of a vessel, they are little better than the merest guesswork, and might very well prove fallacious; in fact, a yacht is generally sparred upon entirely wrong and hazardous principles. The builder, according to his judgment (which sometimes leads him to a right, and occasionally to a wrong result), fixes upon the lengths of the spars without any reference to rules whatever, as he is conscious that the rules, although mysteriously contrived, might lead him astray. The result of the chance system is that the masts very frequently have to be reduced, and not unfrequently increased in length. A great deal of vexation necessarily follows; but no one can be held to blame, because all concerned had planned the scheme according to their ability.

No doubt masts affect the stability of a vessel to an enormous extent, and we find in Seabelle that 30 per cent. of her ballast goes to counteract the leverage of her masts alone. A cutter is better off in this respect, as she has only one mast; but even in a cutter as much as 20 per cent. of the ballast was found to be required to balance the moment of the mast. As masts so largely affect the stability of a vessel, it will perhaps be conceded that a little more care and trouble should be taken in placing one than there is over sticking a hop-pole into the earth. Now the position of a vessel's centre of gravity can be approximately calculated before she is built, and the exact influence the mast will have on that centre will form a large item in the calculation. The objections which we have heard urged against making these calculations are, firstly, that they are very troublesome; and secondly, that in the hands of an incompetent person they might be as misleading as any empirical rule. The obvious reply to these objections is, that, troublesome as the calculations may be to those who ordinarily construct yachts, plenty of men could be found who would undertake them; and to the second objection we would reply by the question, Why should such calculations be placed in the hands of incompetent persons? But a naval architect would not be content with calculations, but would test the stability of a vessel he had designed, unmasted, when afloat. After these experiments had been conclusively made, the effect of a certain length and weight of mast upon the stability could be easily calculated. The sail area would next be determined by the stability of the vessel thus masted, as explained in Chapter V. It might be found that the figure and area of the sails allowed of the masts being reduced; and there would be this certainty, that, whatever was wrong with the vessel, she was neither over-sparred nor over-canvassed. It certainly does seem incredible that, when there is a certain way of proceeding, yacht constructors should persist in deciding on the length of spars by "rule of thumb," and then giving the length of those spars to the sail maker, who gets as much canvas upon them as he conveniently can.

One of the so called "rules" referred to is to make the length of the lower masts proportional to the beam; and, although this rule might easily be misleading, yet is it as much to be relied upon as some of the others, which are a little more complicated.

For schooners, the rule was to make the foremast, measured from deck to hounds, equal to the breadth multiplied by 2·7, and length of the masthead equal to 0·18 the length of mast from the deck to the hounds.

Mainmast, breadth × 2·85, with length of masthead equal to 0·18 of the length of mast from deck to hounds.

Main boom equal in length to length on the water line multiplied by 0·58, and main gaff equal in length to 0·7 of the length of the boom.

Length of fore gaff equal to 0·322 of the length on the load water line.

Bowsprit and jib boom outside the stem = breadth × 1·75.

For cutters, the length of mast, deck to hounds, was put at 3 times the greatest breadth, and masthead 0·2 of the length deck to hounds.

Main boom, the length on load line multiplied by 0·97.

Main gaff, 0·63 of main boom.

Bowsprit outside the stem, breadth × 2.

These proportions appear to be still followed with tolerable exactness, but are of course variable, as will be gathered from the table which follows. In this table, the length on the load line is given, and the breadth, and the proportions the spars bear to these dimensions.

The ratio of the length of bowsprit is given in terms of the length of the load line, but generally the proportion is approximately double the breadth of the beam. As the length of vessels in proportion to the beam, has been much increased of late years, the main booms now are not nearly 0·97 the length on the load line, in fact the ratio is more nearly 0·8 of such length.

The bowsprit, it appears, does not bear a constant proportion to the length on the load line; and it is obvious that the length of the bowsprit and the length of boom or gaff must depend upon the requirements of the centre of effort of the sails, and upon their figures or shapes.

Name.	Length on L. W. L.	Breadth on L. W. L.	Length of Mainmast, Deck to Hounds.	Ratio of Foremast to Mainmast.	Ratio of Mainmast to Beam.	Length of Bowsprit outside Stem.	Ratio of Length of Bowsprit to Length L. W. L.	Extreme Length of Main Boom.	Length of Main Gaff.	Area of Lower Sails.
	FT.	FT.	FT.			FT.		FT.	FT.	SQ. FT.
Sappho	122	26·5	73·0	0·94	3·07	*a* 66	0·55	81	47	10223
Guinevere	121	23	69·5	0·93	2·95	44	0·36	77	44·5	8611
Shamrock	105	24·5	66·0	0·91	2·64	*b* 39	0·37	64	39	6985
Livonia	107·5	23·3	66·0	0·95	2·80	38·5	0·35	70	43	7618
Columbia	98·5	25·5	69·5	1·00	2·70	*c* 57	0·57	72·5	34·5	8772
Aline	100	20·9	63·0	0·93	2·90	34	0·34	63	36	6710
Cambria	100	20·5	62·0	0·93	2·95	41	0·41	63	37	6418
Gwendolin	100	20·5	63·0	0·92	3·03	39	0·39	70	39	6903
Egeria	93·7	19	58·0	0·90	3·00	32	0·34	63	36·5	5988
Seabelle	90.5	18·9	59·5	0·87	3·13	36	0·40	63	38	5780
Pantomime	91·5	19	57·5	0·92	3·00	31·5	0·34	58	35	5657
Dracæna	80	17.8	52·0	0·94	2·90	28	0·35	48	30	4005
Flying Cloud	73·5	15.5	46·0	0·95	2·93	23·5	0·33	46·5	28	3632
Florinda	85·7	19·1	54·5	...	2·83	36	0·42	56·5	42·5	5257
Oimara	95	19·8	58·5	...	2·93	47	0·50	70	47·5	5500
Kriemhilda	79·3	17·3	47·5	...	2·72	36	0·45	65	43·5	4405
Vol-au-vent	79·5	17·2	48·5	...	2·79	34	0·42	67·5	43	4500
Fiona	73·5	15·8	44·5	...	2·78	34	0·46	60	38	3720
Iona	71·2	14·4	43·5	...	3·02	32	0·45	57·5	35·5	3350
Bloodhound	59·8	12·1	38·0	...	3·37	28	0·46	49	31·5	2600
Gleam	59	12·4	36·5	..	2·90	26	0·44	48	32·5	2500
Myosotis	59	12·3	37·0	...	3·00	27	0·45	47	31·5	2450
Vanessa	47	9·8	31·5	...	3·18	24	0·51	39	27·5	1732
Ildegonda	40	9·4	29	...	3·08	20·6	0·51	36	27	1650
Dudu	39	9·6	28·2	...	2·87	20	0·51	33·5	24	1620
Torch	43·5	8·9	28·5	...	3·20	20·3	0·47	34·5	23·4	1630
Lily	36·6	8	25·0	...	3·09	17	0·46	31·5	23	1095
Pastime	37·3	7·8	25·0	...	3·20	17	0·45	31·5	22·5	1000
Freda	30·5	6	21·0	...	3·44	15·5	0·50	26	18·5	680

a Bowsprit, 30ft.; jibboom, 36ft. *b* Bowsprit, 24·5ft.; jibboom, 20ft.
c Bowsprit, 24·5ft.; jibboom, 33ft.

With regard to the placing of the masts, a great many rules have been given; but the soundest advice is to keep them as near to the centre of gravity of the vessel as possible, if it is sought to make a yacht easy in a seaway. The weight of the masts, by lengthening out the radius of gyration, much increases the violence of pitching; and the shorter masts are, and the nearer they are stepped to the centre of gravity of the vessel, the less they will operate to aggravate pitching. A quarter of a century ago, the

America introduced the fashion of raking masts aft, and no doubt there was some reason in it, if it were absolutely necessary that masts should be stepped very far forward. By raking the masts aft, their weight was carried aft in proportion to the sine of the angle of rake, and so that, although a mast might have been stepped very far into the bows of a vessel, yet would its weight fall very near the centre of gravity. However, experience soon undid this fashion, as it was ascertained that sails of better figures, which could be more easily worked, were to be obtained by stepping the masts a trifle further aft, and upright. So far as cutters are concerned, the general rule appears to be to step the mast 0·4 of the length on the load water-line abaft the fore side of the stem.* This position is found to be near enough to the centre of gravity of a vessel to avoid any bad effect on her ease in a seaway; and generally, if any good results through stepping a mast 6in. further forward or aft, the good is traceable to the altered position of the centre of effort of the sails rather than to the shift that has been made to the weight of the mast. Of course, if the centre of effort of the sails cannot be altered or adjusted, without shifting the mast, this extreme measure must be adopted; but the constant craze some sailing masters have for shifting masts backwards and forwards should never be gratified from the mere assertion of "I'm sure this 'ere vessel would do a great deal better if her mast was moved six inches further aft; we shifted the old Nailsick's six inches aft, and she went as well again afterwards." This is usually the skipper's "theory," and, as the builder is very properly anxious to do anything to improve his construction, the mast is generally shifted after the skipper's sententious opinion. A mast may require shifting; but often a little addition to the fore foot, or a little taking away, or a trifling alteration to the sail plan, will correct a vessel's indifferent performance on a wind.

The mast of a yawl is generally placed a little farther forward or about ·38 of the length on the load line abaft the fore side of the stem. The mast is placed so far forward in order that the mainsail may be large, and the probability is that the mast will in future be put even farther forward now that the Y.R.A. have limited the extension of the boom aft the stern post to one-fifth the beam. In a yawl the dimensions of the mizen spars are usually about one-half those of the main.

With regard to schooners, the present excellent plan is to make them as much like cutters as possible. In racing vessels at least the comfort of a good large boom foresail is an unknown thing; but the advantage of having a big mainsail, or as much canvas as possible in one piece, is too great to be sacrificed for comfort. In a like way the exigencies of yacht racing have gradually turned the once comfortable yawl, with her mizen stepped close to her rudder-head, into a vessel that, so far as her ease in a sea is dependent on her spars, might almost as well be a cutter.

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* A quarter of a century ago, when vessels were shorter in proportion to breadth, a cutter's mast was usually placed 0·334 to 0·371 of the length on the load line abaft the fore side of the stem.

In determining upon the length of main boom, the designer of the sail plan will be almost wholly guided by the figure of the sails; nevertheless, it must be always borne in mind that the shorter the boom is, the lighter it will be, and the more the weights—which are necessarily above the centre of gravity—can be reduced, the stiffer the vessel will be. Some confusion, however, occasionally appears to exist about the quarters of a vessel bearing the weight of the boom by some independent support, and sailors frequently say of a vessel, "She'll never bear the weight of that great boom with them lean quarters." Now, it has already been pointed out that any weight a vessel carries has its support through the common centre of gravity of the vessel (page 6, Fig. 3); and lean quarters will no more interfere with a vessel carrying a long and heavy main boom than a lean bow will. But a long, heavy boom, the same as a long, heavy bowsprit, will tend to increase the momentum acquired during pitching and scending in a sea way; and, moreover, it will also tend to increase these motions because a main boom is somewhat free in its action, and is not stayed in an immovable position, the same as a mast or a bowsprit is. Then, again, a main boom is always more or less off the lee quarter, and thus assists in heeling a vessel; and, of course, the heavier a boom is, the more potent this assistance will be. But a "leanness" of the quarters has nothing to do with this matter, further than that lean quarters affect the general question of stability.

In giving a vessel a light boom, however, it should never be lost sight of that about the worst thing in a vessel's outfit is a weak boom. With a weak boom the mainsail can never be made to stand properly if there be the least semblance of a breeze; and, moreover, so far as danger to the crew goes, a worse accident cannot happen to the spars than the breaking of the main boom.

The sizes or girths of spars vary a great deal according to the pine chosen, but the general fashion now is to have Oregon or Vancouver pine for masts, and red pine for booms and bowsprits. The diameter of masts at the deck is generally from ·022 to ·03 of the length from deck to hounds; thus, say a vessel has a mast 30ft. from deck to hounds, then the diameter at the deck will be 30 × ·25=0·75ft. or 9in.; this will be for tough Oregon pine; for pines of less breaking strength ·027 will be a better proportion. The diameter of the mast at the hounds is generally about

·85 of the [illegible] then ·75 × ·85 = [illegible]

The bow[illegible] is generally ·04 [illegible] the sheave or [illegible]

The diam[illegible] greatest if the [illegible] greatest diam[illegible] the mast, is [illegible] diameter of the [illegible] For a laced sail [illegible] 25 per cent.; [illegible] not venture upon [illegible]

A great many [illegible] a view of lightening spars [illegible] yet been displaced. [illegible] appeared with "built [illegible] cask; but the plan [illegible] we think it was in [illegible] after two or three [illegible] were unceremonious[illegible] hit upon the idea [illegible] missioned to bore the mast [illegible] performed by long auger[illegible] of the spar's length. Th[illegible] doubt the spars were very [illegible] afterwards had her masts bore[illegible] when the Cambria's foremast [illegible] deter the owner of the Cambria [illegible] thought it prudent to [illegible] equal intervals, and [illegible] pendants and runners [illegible] heads; but the weight [illegible] equal in weight [illegible] spars; and, [illegible] at the masthead, [illegible] of the spar [illegible] benefit was [illegible] carry them, and [illegible] Harvey Cam[illegible] sp[illegible] each half, tapering to correspond with the tapering of the spar. In boring, the bore was, of course, of uniform diameter throughout; hence the weakness at the mastheads. The John Harvey Company, before putting the spars together, ploughed and tongued each side, and then bound the whole together with iron bands. The Miranda schooner raced throughout the season with a bowsprit made in this way, and in heavy weather. The spar stood well, but a similarly made main-boom became damaged through imperfect fitting at the sheet-strop.

CHAPTER IX.

SELECTING A YACHT.

BUYING a yacht is pretty much like buying a house, a carriage, a horse, or a watch; a man must regulate his taste and purchase by his pocket. If he is really fond of the sea, and looks forward to the sailing with the professional keenness of a middy or apprentice, he will not think so much about the size of a yacht as about getting something that he can manage himself, and graduate in for the Board of Trade certificate. If, on the other hand, the dawning yachtsman has boundless wealth, is a little of a sybarite, and determines to spend two or three months afloat because it is the fashion, he, too, will get a yacht to his taste; but she will probably be a big stately schooner, or an equally big but little less stately-looking yawl, as big cutters are no longer fashionable.

The man who is going eventually to become a thorough yacht sailor will of course begin his apprenticeship on board a cutter, and she will not be bigger than 5, 10, 15, or 20 tons. If she is as big as 10 tons, he should make all the passages in her when shifting ports, and not bid farewell to her at one pier head, and welcome her arrival from another pier head at the next watering place on the coast. If a man goes about attended by the uncomfortable feeling that he shirks all the real daring and adventure of yacht cruising he is not likely to make a perfect yacht sailor; as sailing in ten or twenty matches during a summer, and sleeping in a snug berth in smooth water for a couple of months or so, are of little value compared with the under-way drill inseparable from making passages, it being understood, of course, that the owner does his "trick at the wheel." But it is not only the ten-ton ship that is big enough to convey the manly form of the youthful yachtsman from port to port; many owners of 5-tonners as bold as Will Watch, "take the helm and to sea boldly steer"; and these are the ones we always find to be the best sailor-men, even though they do not win so many prizes. Of course, living in a 5-tonner to the majority of yachtsmen would be utter misery, and perhaps death. The budding yachtsman has been in the habit, perhaps, of spending a couple of hours every morning over his toilet, surrounded by all the luxuries of the upholsterer's art—velvet-pile carpet, satin damask, cheval glasses, water-colour drawings, Dresden china—and perhaps a valet-de-chambre. The man that has been used to this sort of thing must have the big schooner or yawl, for he will find no room for them inside a 5-tonner. He must carry his clothes in a bag, or cram then into a locker 2ft. by 6in.; go on his marrowbones to shave; into the sea for his bath—it is only one step and overboard;—and if he is addicted to cosmétique, he will probably find a piece of "common yellow" a good substitute. The cuisine, of course, would not be such as would raise water bubbles in the mouth of a valetudinarian; the carnivorous propensity will mostly be gratified by steak which, when cut, will resemble the Mudhook Yacht Club burgee of *rouge et noir*; and savoury soups and luscious salmon will be luxuries only obtainable in "canister" form. With all this, the five-tons man will very rapidly become a sailor, and the little ship below will be as neat and cosy as a woman's boudoir; he will have a place for everything, down to a housewife; and at the end of one summer there will not be a part of the ship, from the breast-hook forward to the transom-frame aft, that he will not know the use of.

Of course, for real comfort at sea, the bigger a man can afford to have a yacht, the better; but it will seldom be advisable to go beyond 300 tons, as very large vessels are more or less, according to size, unhandy in narrow channels and crowded roadsteads. A yacht of 150 tons and upwards should be schooner-rigged; and we are inclined to think, if her size reaches 300 tons, or say 120ft. in length on the load water-line, that she should have three masts, with all fore-and-aft canvas. "Square rig forward" is sometimes recommended for a three-masted vessel; but, although square topsails may be of occasional use in backing and box-hauling, or in scudding, yet the extra weight aloft, and the extra gear, are usually considered more than a set-off against these advantages.

A yacht from 150 to 80 tons downwards can also be schooner-rigged, but many yachtsmen prefer the yawl rig for these and intermediate tonnages. The yawl will be the more weatherly craft, will reach as fast, and be faster down the wind. The actual weight of spars will be less for the sail area; there will be less gear; and there will be no mainmast obtruding in the main cabin, or in one of the berths abaft it. In bad weather a schooner is very handy under main trysail, reefed fore staysail, and fourth jib (foresail stowed); a yawl under similar conditions would have main trysail, reefed foresail, and fourth jib, with mizen stowed, and would be quite as handy, and would perhaps lie-to a little more quietly. There will be no difference in the number of men required to work either rig, size for size, and on the whole we are inclined to think that the yawl rig is to be preferred.

But the yawl for comfort must be the real thing, and not merely a big cutter with a long counter, and a mizen mast stuck on the archboard for the sake of "tonnage allowance for rig." This latter class of yawl has really a greater weight of spars in proportion to sail area than a cutter. The main boom is, in a yacht say of 100 tons, within 6ft. or 7ft. as long as the main boom of cutters of equal tonnage; the mast is as long, the bowsprit as long, the topmast as long, the gaff often longer; and the weight of the mizen-mast bumpkin, yard, boom, and rigging is generally about ten times the weight of the extra length and extra size of the cutter's boom. These are not the yawls that have an advantage over even large cutters for comfort; and the mizen mast is generally stepped in such a "dickey" fashion that it is not safe to put any sail on it in a real blow, when it might, according to the notions of the sailing master, save the crew some trouble to get under way with mizen and head sail alone instead of with trysail. Now, the modern *racing* yawl has so little advantage in snugness over a cutter of equal size, that our advice always would be, for racing—to enjoy the sport with an equal amount of comfort—have a cutter up to 120 tons, and above that tonnage a schooner—say one of 140 tons.

But the cruising yawl proper is a very snug vessel indeed, and has nearly all the good qualities of a cutter, and is really a more comfortable craft, and can be worked with fewer hands, which of course means at less cost. Her mizen mast will be stepped close to the rudder head, instead of at the extreme end of the counter; her bowsprit will be short and light; her mast will be lighter than a cutter's; and so will her boom, gaff, and topmast be lighter. Her mizen mast will be so stepped that it will be safe in the most violent wind storm to put sail upon it; and this may be often of real advantage in clearing out from an anchorage in a hurry.

It might very well be here asked, if a yawl has so many virtues, is so snug and so comfortable, why should not her rig be recommended for vessels of eighty tons and under? The answer is that, as a snug cutter of 80 tons can be as easily handled and as cheaply worked (six A.B.'s would be required for either) as a yawl of 80 tons, they are to be preferred on account of their grand sailing qualities. The line is drawn at 80 tons for this reason: a gig's crew must be had out of yawl or cutter, and if four hands be taken away in the gig, two will be left on board to work the yacht with captain and mate; and even a 60-tonner cannot very well do with less than six A.B.'s for the above reason. But, whereas six men may work an 80-tonner, whether cutter or yawl, six would be hardly enough for a 100-tons cutter, although they might be quite equal to a yawl of that tonnage; and moreover, if there was anything like a breeze, and four men had to leave the ship in the gig, it would be hardly prudent to leave the sailing master and mate with two men only on board. Of all the rigs which the ingenuity of man has devised, not one is equal to the cutter, whether for clawing to windward, reaching along the wind, or running down wind. A cutter with a true wind will beat as far to windward in a day as a yawl will in a day and a quarter; will walk off with a light air when the medley-rigged craft is as good as brought up; and in a breeze under topsail is even more comfortable and easy than the yawl. But the cutter must be snug; there must be no aping the racing cutter, and all the spars must be pretty nearly reduced to the dimensions of the yawl: that is, the boom end must about plumb the taffrail; the bowsprit—say for a 100-tonner—must only be about eighteen inches longer than the yawl's; the mast must only be a little heavier; the topmast must be no longer; and the gaff must be in due proportion to the boom. A common argument in favour of yawls as against cutters is this; a racing cutter of 80 tons is said to be an expensive vessel to work, is an awkward vessel to tackle in a sea, and is wet and uncomfortable, therefore do not have a cutter. But, on the other hand, if you wish to do a little racing without sacrificing comfort or incurring expense you are disinclined to, have a yawl of 80 tons; the allowance for rig will put the vessel on an equality with the cutter, and she will win plenty of prizes; that is, in the yawl rig a really comfortable cruizer can be had combined with qualities good enough for racing successfully.

There possibly is a very great delusion about this. A yawl to be a successful racer must be ballasted and canvassed pretty much as a cutter, and the expense of racing a yawl can differ very little from that of racing a cutter; probably, tonnage for tonnage, the expense would be the same. There is as much difference between a cruising yawl and a racing yawl as there is between a cruising cutter and a racing cutter, and it is a great mistake to suppose that a racing yawl includes the comforts of a good cruising cutter of equal size.

As pointed out, "rig" will depend upon size: for cruising, cutters up to 80 tons; yawls from 80 to 150 tons; schooners above that tonnage.

In deciding on a yacht for racing, the first thing to exercise the mind is, of course, which is the best size to have? A builder will not unnaturally recommend something very large—something that one can live in with comfort and with all the luxuries of shore life, and at the same time cut an imposing figure in the yachting world. But, as a rule, very large craft are disappointing. If a schooner is decided upon, it will be best not to go much beyond 200 tons; and a yawl should not exceed 150 tons, nor a cutter 120 tons. It can be argued that years ago, in the latter half of last century and at the commencement of this, very large cutters, sometimes exceeding 200 tons, were afloat, and were so much superior in every good quality which a sailing vessel should have, that they were always referred to with pride as the "national rig." This is very true; but the 200-tons cutter of fifty years ago was a very different kind of craft from what a 200-tonner of the present day would be. These old cutters were only about 80ft. long on the load line, with a 25ft. beam; they had taunt masts, and what appeared to be long main booms, as so much projected over the taffrail aft; but in fact their main booms were comparatively short—about 65ft., or no longer than Kriemhilda's, which we reckon as of 106 tons. Now a 200-tons cutter, built according to existing ideas as to proportion of beam to length, would be a very different kind of ship indeed; she would be about 100ft. long, and have no more than 22ft. beam; but, instead of being weighted with stone for ballast, she would carry probably 100 tons of lead, and her main boom would be at least 80ft. long. Having had some experience in handling a cutter's main boom that was a little over 70ft. in length, we are quite of opinion that a 200-tons cutter, or even one of 150 tons, of the modern school, is not a desirable kind of racing craft; and 120 tons—which means about 90ft. length of load line, or more than the old Alarm had when she was a 193-tons cutter—is quite a prudent limit to strike.

But a man may be uninfluenced by considerations of size, comfort, prudence, or cost; he may simply want to shine as the owner of a successful racing craft, and pile up a huge, if almost meaningless, heap of prizes in one year. If such is the desire, search must be made amongst the records of matches sailed during the last decade, and little difficulty will be found in coming up with the magic size for prize-winning. So far as the record of the decade now closing goes—or, indeed, the record of the last thirty years might be taken—we think there is not much doubt that the most useful size, so far as cutters are concerned, for successful racing, is 60 tons or near that tonnage. Mosquito, Volante, Fiona, Vanguard, Iona, Neva, have achieved more in the way of prize-winning than any of the same rig of 100 tons and upwards; and even now, when the very finest examples of big cutters ever known are afloat, the statistical evidence of the money value of prize winnings is all in favour of vessels of and about 60 tons. It is true that in 1873 the Kriemhilda, of 106 tons, in the face of almost unexampled competition, won more than any cutter had previously done, and the brilliancy of the achievement was enhanced by the circumstance that she won a first prize every time she started but twice, and came in first every time but once, and all the matches were sailed in good breezes. This latter circumstance somehow appears to have a great deal to do with a big vessel's success; and it is generally found, if there has been a succession of light baffling winds during the summer, that the smaller craft come off the best, so far as prize-winning goes. It therefore appears to be pretty clear that, for competition in the large class, a cutter of from 60 to 80 tons should be chosen, as the probability is, if the vessel be a good one, such as Ratsey or Fyfe builds, that a very valuable amount of plate will be collected. On the other hand, more *éclat* naturally attends the successes of a big craft: she is generally ahead of the fleet—and the sympathies of the crowd invariably go with the leading craft; and if she wins (say from a 60-tonner), she is almost certain to be three or four miles ahead at the finish. This feature in itself is, no doubt, a most impressive one, both on the owner and on the spectator; and there can be no question about the *éclat* of winning with a 100-tonner eclipsing the splendour of winning with a 60-tonner. This certainly is the vanity of the thing; but there are vanities in sport as there are in other occupations, and if it is a man's vanity not only to win prizes, but to revel in the glory of "coming in first" in the cutter class, then he must have a vessel of 100 tons or 120 tons. If, on the other hand, his vanity, if more peculiar, is less ambitious—is to win, one way or another, the greatest number and the greatest value of prizes—then he certainly should not go beyond 80 tons nor below 60 tons in selecting a vessel.

Cutter racing is not confined to 60-tonners nor to 100-tonners. Within the last ten years classes have sprung up, and no class has earned more laurels than the 40-tonners. Three builders—Hatcher, Fyfe, and Ratsey— have made this class, and hitherto no other builder has been able to compete with the production of these famous constructors. For real sport, there is not much doubt that the 40-tonners are to be preferred to the vessels in the larger class; there is no time allowance; the exact merits of the vessels, and of their handling, are easily read; and, as a rule, the winning vessel can only arrive first at the goal by contesting every inch of water sailed through. An attempt was made five or six years ago to establish a 60-tons class, but it fell to pieces, mainly because sailing committees did not promptly stop the introduction of vessels "a few tons over the class." However, we do not think a 60-tons class was much to be admired, and probably a class [illegible] would have [illegible]

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revival of the class—which, by the way, is recognised by the Y.R.A. A great many contend that the 15-tons class should have been encouraged instead of the 10-tons. There can be no doubt that a 15-tonner is a more comfortable cruising craft than a 10-tonner; but the expense of working the former nearly approaches that of working a 20-tonner; and, whatever advantages may belong to the class, it is not likely that its existence will much interfere with the 10-tonners.

CHAPTER X.

EXAMINATION OF THE YACHT.

After having decided upon the size of the yacht, the next step will be to find one of suitable size. If the intending purchaser advertises his wants, he is certain to have a great many vessels offered him, and all will be highly recommended by the agents of the vendors; each vessel will be the best sea boat of her tonnage, the strongest built, the best found, and the handsomest; and, moreover, the present owner is almost certain to have recently spent several hundred or thousand pounds upon her reconstruction or redecoration. The purchaser will be delighted; he will think what a beautiful refuge from the maddening crowd and frowsy city the yachting world must be; all the white-winged barkies are as lovely, as safe, as strong, and as pleasant in a sea as his imagination had conceived them to be when dreaming of

> The glad waters of the dark blue sea.

And how generous of every owner to spend so much on his property for the sole benefit of the next purchaser! After having got through particulars of the splendid fleet that have been offered for sale, something like bewilderment will naturally follow; and the task of making a final selection will be a little difficult. The best plan will be to begin with treating all the answers as mere information of vessels for sale. Find out when they were built, and by whom, from Lloyd's Register,* and if those that seem unobjectionable, so far as age is concerned, are suitable also in price, go to see them. Then, if one appears to be in every way a desirable craft, bid for her, "subject to survey and inspection of inventory," to ascertain if her hull and equipment are in a seaworthy and satisfactory condition. It will always be necessary to have a vessel surveyed before completing a purchase, unless it is found by Lloyd's Register that the yacht is quite new, or has recently been surveyed. If a survey be required it will be performed upon application by one of Lloyd's surveyors, or by a yacht builder; but if a builder be employed, it will be well not to have the one that built the vessel, as he may not unnaturally incline towards making a more favourable report on her condition than the circumstances may warrant. The fee for surveying will probably be five guineas, with travelling expenses.

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* Lloyd's Society for the Registration of Ships (White Lion-court, Cornhill) are issuing a special book for yachts, stating their tonnage, when and how built, when altered, when repaired, and all information that it is necessary to possess.

A man may perhaps desire to act as his own surveyor; if he does, he will act very unwisely, as it is only by long experience, and a perfect knowledge of the construction of vessels and of the strains they are subject to, that a man can become competent for such surveys. Nevertheless, as the yachtsman who takes to the sport enthusiastically, and with a resolve to be "thorough," will necessarily want to know in a general kind of way the "marks" to distinguish a good vessel from a bad one, some instruction must be given him.

In the first place as to age. Speaking generally, a yacht should not be more than twenty years old; we do not mean that all yachts upwards of that age should be broken up or sold into the coasting, or fishing, or piloting trade; but that yachts so old as twenty years should be put through a very searching survey. Yachts never are broken up, we think, and their fate, unless they "become a total loss," is to lie year after year in mud docks for sale, and till they are far on the shady side of thirty. Do not be tempted by cheapness into buying one of these; it would certainly end in mortification and disappointment. If the vessel were merely patched up with oakum and paint, she would be a perpetual trouble and expense; and if repaired or renewed as she ought to be, a new vessel had much better be built, as it would be cheaper in the end.

Therefore do not buy a thirty-year-old vessel, and one so old as twenty years should only be selected with very great caution; the condition of such an old craft will depend upon the way she has been used and "kept up," and upon the amount of repairs and "renewing" she has undergone. For instance, some vessels at the end of fifteen years are stripped, newly planked, and decked, and all doubtful timbers and beams replaced by new; such a craft would be good for another ten years without further ~~delay~~ outlay, and she might be bought with as much confidence as a perfectly new vessel. Or if the yacht was originally well built in the best manner by one of the best builders she may at the end of fifteen years require neither new plank nor new frames, but if she has seen much service she is almost certain to require new decks. The condition of a yacht at the end of fifteen years will very greatly depend upon the quality of the materials used in her construction, upon the sizes of the timbers and their disposition, and upon the thickness of the planking, and upon the strength of the fastenings. Some idea of what these should be can be gleaned from the tables (given farther on) compiled from the practice of the best builders of yachts. The timbers (called also frames, and first, second, and third futtocks, where the lengths of the frames are in two, three, or more pieces) will be "double," that is, two timbers or frames will be placed close together and act as one. Then there will be a space, and hence "timber and space" means the distance from the centre of one double frame to the centre of another. Some builders do not place the timbers of a double frame quite close together, as some ventilation is considered a good thing; but greater strength is obtained if the timbers of each double frame are close together, and the general practice is to so place them close together.

Occasionally a single-framed vessel is to be met with—that is, instead of two timbers being worked close together to form one almost solid frame, one single timber forms each frame, placed at regular intervals. These vessels, unless the timbers are of superior size and placed very close together, should be regarded with great suspicion; the space from centre to centre of the timbers should be at least 25 per cent. less than in a double-framed vessel, and the sizes should be 15 per cent. greater. In almost all vessels the frames of the bow forward of mast are single, and in some old vessels these bow frames might be found to be of fir; these frames will require a great deal of inspection and pricking. Some 20-tonners which we have met with have had single frames 12in. from centre to centre in the middle of the vessel, these frames extending over a distance equal to half the length of the vessel; similar frames were used in the bow and stern, but the spacing was increased to 16in. There does not appear to be any objection to this plan, and it has a slight advantage in weight of timber. A plan adopted by Mr. Alex. Richardson in framing the 10-tonner Lily was as follows: Sawn frames (4½in. by 2in. under platform, tapering to 2½in. by 2in. under deck) were spaced 3ft. apart, and between each pair of these were three steamed timbers 2in. by 1½in.; this framing has stood fairly well, and for lightness could be recommended. The Harvey Ship and Yacht Building Company use alternate sawn and steamed frames, with a double skin. This plan has scarcely had a trial yet, but, so far as the experience of four years goes, it appears likely to be very durable, and has an advantage in lightness. In regard to "materials," all the frames should be of oak and so should be the stem piece, stern post, dead woods, knight heads, apron, beams, shelf, and keelson; the keel will generally be found to be either English or American elm. The garboard strakes are generally of American elm, and it is best that the planking above should be of American elm or oak to the load water-line, and teak above to the covering board or deck edge. Very frequently, however, only the garboard strake is of American elm, and the remainder red pine or pitch pine, with a top strake of oak. Again, sometimes the first four strakes above the garboard are of American elm, and the first four strakes below the deck of oak or teak, and the remainder pine. Occasionally oak plank is used at the bilge, with a wale or "bend" of oak above the water-line; and, again, sometimes the plank is all oak from keel to plank sheer, and nothing in the way of wood material can exceed the strength or durability of a vessel so planked.

The floors and keel fastenings of yachts are now variously contrived. Twenty years ago a builder never thought of constructing a vessel without grown floors and a keelson; but, owing to the increasing sharpness in the bottoms of vessels, or increasing "dead rise," it became very difficult to find suitably grown floors. The result was that iron floors were cast, and these, whilst having an advantage in strength and durability, have the additional recommendation of forming excellent ballast. In some cases (almost always in vessels of 40 tons and under) grown floors, or floors of any kind, are dispensed with entirely; the heels of the first futtocks are brought down to the keel and connected by iron knee plates, which are securely bolted through a hogging piece and keel.

If a yacht is met with that has these iron knee-floors, it should be ascertained if she has been ballasted with lead; if it turns out that her ballast has been lead, it will be necessary to have the iron knees very carefully examined, as lead very quickly destroys iron. It should also be ascertained whether or not the floor bolts and other fastenings are of iron; if they are, it is just possible that the lead ballast may have eaten off their heads.

If the yacht be twelve or thirteen years old, it will be incumbent to examine her very thoroughly inside and out, unless it is satisfactorily shown that she has recently been so examined, and all necessary repairs made. To effectively examine a yacht the copper should be stripped off, and the planking scraped clean; if, however, the copper be good it will be a pretty fair argument that the plank underneath is sound, as the copper in such a case is not likely to have been on more than three years; and, of course, the plank and caulking would have been thoroughly examined and made good when the vessel was re-coppered.

If it is stated that the vessel does not require re-coppering nor needs stripping, it will be well to be present when she is hauled up high and dry, or as the water is pumped out of the dry dock into which she has been placed, as the case may be; as, if there are wrinkles or folds in the copper, giving evidence of strains, it is quite possible, where the opportunity exists, that these "wrinkles" would be "dressed" out. The wrinkles will generally appear in a longitudinal direction, under the channels and under the bilge over the floor or futtock-heads. But if the vessel has been subject to very severe rackings or twisting strains, or has bumped on a rock or on very hard ground, the wrinkles may run diagonally across the copper. Very long and deep yachts, that have not been properly strengthened by internal continuous diagonal braces across the frames, may be subject to great racking or twisting strains; if there be evidence of such strains, the yacht need not be condemned, but she will require strengthening at the hands of a competent builder. In a case where the copper shows unmistakable signs that the vessel works or strains, she should be thoroughly examined in the vicinity of the supposed strains, and be strengthened and fastened in the manner which a builder from his experience may consider necessary. If iron fastenings have been used in the vessel, it is very likely, unless the heads have been counter sunk and well cemented, that iron rust stains will show on the copper; if such stains are met with, it will be best to have a sheet or more of copper stripped off, and have the fastening driven out and a new one put in its place. The keel should be examined for strains and splits; and if the keel or false keel be worn away from the through bolt fastenings, the bolts should be cut off and re-clinched, or a new false keel be fitted.

The stern, rudder-post, rudder, braces, and pintles must be examined, and if the rudder-post is twisted, or braces or pintles much worn, there will be work for the shipwright.

The chain plates and chain-plate bolts and the surrounding planking should be closely examined for flaws and strains, and so also should the stem piece and bobstay shackle plates.

Signs of straining on deck will mostly be apparent in the seam of the covering board abreast of the mast, at the stem, knightheads, bowsprit bitts, and near the masts. If the seams are unusually wide here, as they frequently may be in a yacht that has been much pressed with canvas, some strengthening will be required by more hanging knees under the beams, and additional knees at the mast partners, or new beams, partners, and knees altogether. If the covering board shows signs of having opened badly in the seam, or lifted from the top strake, the beam ends and shelf will require very careful examination—the latter especially at the scarphs and butts.

To examine the frame of the vessel, the ballast should be removed, and some of the ceiling and outside planks should be stripped off. Lloyd's surveyors, in examining an old ship, usually cut out listings from the plank the whole length of the ship; and they also similarly cut out listings from the ceiling inside, under the deck, and over the floor heads; planks are taken off, too, at different parts of the ship, equal in the whole to her length; and the beam ends are examined either by taking out the top strake under the covering board, or by boring under the covering boards. Fastenings, such as trenails and bolts, are driven out, to further test the condition of the frames and fastenings; and the condition of the oakum and caulking is ascertained by examination in several places. If the ship or yacht be completely ceiled up inside, it is obvious that the whole of the framing cannot be examined by such means; but generally a yacht is not so closely ceiled, and an application of a knife to the frames will soon determine whether they are rotten or not.

There is scarcely any limit to the number of years frames of autumn-cut oak will last; but occasionally a sappy piece will find its way among the frames, and it may not last a year, or the frames may decay in consequence of leakage and defective ventilation; but from whatever cause rot may arise, any frame so affected should be removed. Heels and heads of floors and frames are the most likely places to find rot; but of course it may occur in any part of a frame, and, if possible, every timber in a vessel should be thoroughly examined from heel to head.

Old decks are a great trouble to keep tight; and if there is any sign of "weeping," either under the deck at the seams, round the skylights, shelf, or mast, there will be sufficient evidence that caulking is necessary. New decks, however, frequently give trouble in this way if they have been carelessly caulked, or if the yacht has been weakly constructed, or if the caulking was done during wet weather and not under a shed. As the plank dries, it shrinks away from the caulking and paying, and leakage is the inevitable result; this condition can be somewhat ameliorated by wetting the deck two or three times a day, but wet decks are almost as bad as leaky ones, and re-caulking and stopping will be the best remedy. It is the fashion now to lay the deck plank very close together, in order that narrow seams may be obtained; narrow seams of course look very nice, but, as the seams are scarcely wide enough to receive the caulking iron, very little oakum is driven into the seams, and as the marine-glue paying or putty stopping dries, leaks are the result.

The spars will require careful inspection, and if either has cracks running transversely or diagonally, it will be pretty sure evidence that it is sprung. The longitudinal cracks or fissures are not of much consequence unless they gape very much, run deep and from one into another right round the spar; sometimes, however, if the cracks have not been stopped with putty or marine glue, the wet might have got in and caused decay. The insertion of a knife into various parts of the crack will soon settle this matter. The mainboom should be examined for "springs" near the outer end chiefly; the bowsprit at the gammon iron, or stem head, and at the outer end above the sheave hole; the mast, about the deck and under the hounds. The masthead will require very careful examination under the eyes of the rigging for rot, and right away to the cap for wrings, which generally show themselves by a lot of little cracks.

The rigging, blocks, and sails will of course require an overhauling. The standing rigging is now generally made of galvanised iron wire or steel wire; if it has seen much service, rust from the inner strands will show itself, and the "lay" of the strands will have been stretched out. Hemp and manilla rope, if much worn, with a washed-out appearance, should be in certain places un-layed, or untwisted, and if there be any signs of stranding, or if the tar is dried up, the rope will have seen its best day. The shells of the blocks will require examination for splits, and the hooks, eyes, sheave, and pin for flaws of whatever description. The sails should be laid out and examined; if the stitching in the seams or roping be worn and ragged, if the canvas be black looking, very soft and thin, admitting a great deal of daylight through the woof, then the sails will be only fit for a fisherman or coaster. As a rule, a suit of sails will last through four or five summer cruises; but three months' knocking about, winter cruising in the Mediterranean or elsewhere, will do as much harm as two summer cruises, and it will never be prudent to start on a long winter cruise with sails that have seen more than three seasons' wear. Of course sails may have been exceptionally well cared for—never rolled up wet nor unfairly stretched—and the vessel may have been in the happy condition of never having been under way in much of a breeze. Then if they are six or seven years old, and an expert pronounces them fit for a winter's cruise, they can be depended upon; but to be caught in a breeze is bad enough, and it is a great deal worse if when so caught some of the spars, rigging, blocks, or sails give out. A mainsail is most likely to go at the clew or split from foot to head, but occasionally they split right across from leech to luff. A jib will go all ways; its head will come off, tack or clew will come off, and sometimes they will split or burst out of the stay rope. For racing, a mainsail is of little use after the second year, and even with the greatest possible care they will hardly do the third, as they get thin and soft and fly right away from the spars into bags with the least weight in the wind.

Lastly, the ground tackle or holding gear must be examined. The anchors and chains should be galvanised, and be of the weight and size set forth in the tables for yachts of different tonnages, which will be found farther on.

CHAPTER XI.

BUILDING A YACHT.

Some men seem to have quite a passion for building yachts, whether for cruising or racing, and do not believe in the paraphrased adage that "fools build yachts for wise men to buy." So far as a racing yacht is concerned, it is quite natural that a man should wish her first success or fame to be identified with his name, and that he would not care to own a vessel which had already become famous under another man's flag. On the other hand, there are plenty of men who, directly they hear that a yacht is successful, and read of her wonderful exploits in the reports of matches, long to possess the wonderful craft. And so it happens that there is always something for the builder to do. The man who finds excitement in building is always certain to fancy that there is something even in his last success that can be improved upon; and he is glad to meet with the obliging purchaser who so covets the possession of the property he is anxious to discard.

The man who knows nothing whatever of yachts and yachting, in setting out to build, will be mainly troubled to know which builder to go to. He will hear that one builder is famous for cutters, another for yawls, and another for schooners; whilst another, more wonderful than all the rest, is famous for every kind of craft, from the tiny Una to the bold Mediterranean cruiser of 300 tons. Then, again, one builder is celebrated for the soundness of the materials he uses; another for the excellence of his fastenings; and another, perhaps, for his disregard of the quality of both materials and fastenings. Now, all this will be very perplexing to the man who has yet to serve his apprenticeship at the sport, and he at last dives into it with something like the feeling with which he took his first header, and inwardly appeals to the honour of the builder:

Build me straight, O worthy master,
  Staunch and strong, a goodly vessel,
That shall laugh at all disaster,
  And with wave and whirlwind wrestle.

And probably the master does build him a staunch and strong and goodly vessel. But there need be no doubt about the matter. Lloyd's Society for the Register of Shipping have long been in the habit of superintending the building, and afterwards classifying a vessel; and if builders generally objected, and no doubt correctly, that Lloyd's rules were not quite adapted for yacht building, principally on the ground that those rules required the scantling of a yacht to be unnecessarily heavy, reasons for the objection are now swept away; Lloyd's have, during the past twelve months, modified those rules so as to accord with the undoubted soundness of the practice of the best builders. A yacht built under Lloyd's survey for a fourteen years or higher class is certain to be a "staunch and strong and a goodly vessel;" and it will be of little consequence, so far as these qualities go, which builder has the construction of the vessel, as it will be the duty of the surveyors to see that the work is carried out in a proper manner. Therefore the advice to a man who knows little about yachts cannot be too urgently repeated—always build up to Lloyd's rules and under Lloyd's survey. No matter how high the repute of the builder may be, he will be only the more willing to agree to the survey, and will take delight in showing that he, so far from having any

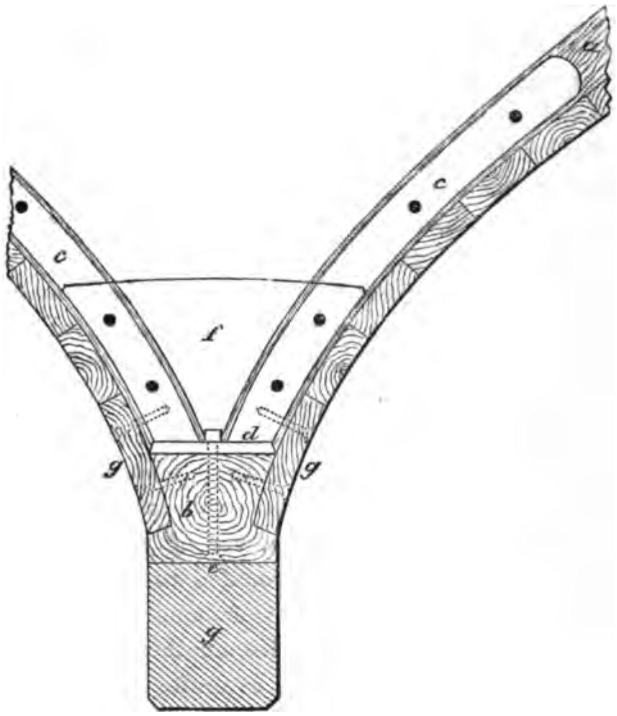

FIG. 1.

objection to build up to Lloyd's rules, will actually exceed their requirements, both in quality of timber used and in fastenings.

Vessels of the racing sort, of 40 tons and under, are now built with keels out of all proportion to the sizes of their other scantling: thus the Lily has a keel sided (by "sided" is meant its transverse thickness) amidships 10in., or as large as the keel of a vessel of 100 tons. This enormously thick keel of course tapers fore and aft, and is only so thick amidships in order that a heavy weight of lead or iron might be carried underneath. A similar weight could only be carried on a smaller wood keel by greatly increasing the draught, and then the strength and thickness of the keel might be unequal to the weight of the lead and the necessary bolts.

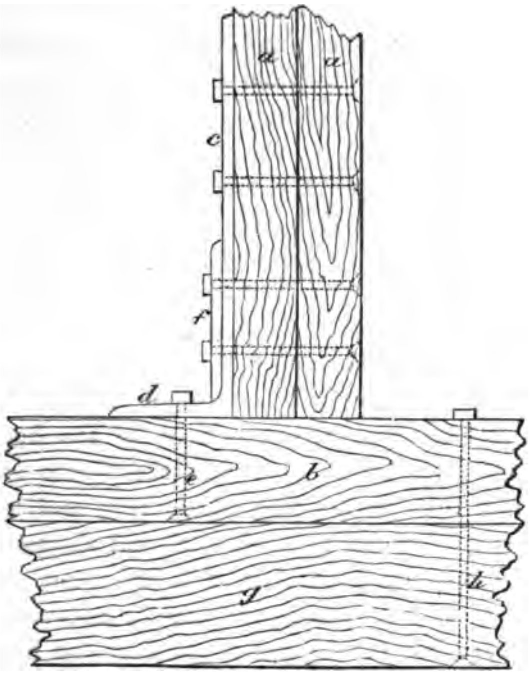

FIG. 18.

Sometimes a lead keel, or keelson, is worked inside, between the heels of the timbers and on top of the keel proper, and this plan will be fully described further on; in the accompanying drawing, Fig. 17, *aa*, are the timbers, the heels of which meet on the middle line of the wood keel *b*; *c* is a wrought-iron knee, bolted to the sides of the timbers, and meeting the keel at *d* in the form of a plate, through which a bolt passes to the under-side of the wood keel at *e*. Across the heels of the timbers the transverse wrought-iron plate *f* is bolted, the same through-bolts serving for knee and plate; the knees are alternately placed the fore side and aft side of the timbers. Fig. 18 shows a broadside view of the construction, *a* being the double timbers, *b* the wood keel, *c* the iron knees, *d* the plate for the keel fastenings *e*; *f* the iron transverse plate, *g* the lead or iron keel, and *h* the bolts for the same. In Fig. 17 *g g* are very deep garboards, fastened, as shown, with long yellow metal or copper spikes; but one bolt might be made to go through garboard and keel.

This mode of construction has recently received a fourteen years' class at Lloyd's for a 25-ton cruising craft, and no doubt it is well adapted for small vessels, for which grown floors cannot be obtained, nor suitable iron floors cast. The iron knees and plates should have two coats of Stockholm tar or black varnish before fixing, and another coat or two before the lead ballast is stowed (the ballast will, of course, be cast to fit between the timbers). The ballast should be removed every season, and the iron knees and plates re-tarred or varnished; and if attention be paid to them in this respect, they will not much suffer from the deleterious action of the lead.

Perhaps the most approved way of constructing the floor and keel of a yacht, where grown floors are dispensed with, is according to a plan adopted by Mr Ratsey. We are unaware who has the honour of introducing the plan, but so long ago as 1858 it was used. Fig. 19 is an illustration of this plan, as pursued in the new cutter now building at Mr Ratsey's. It will be seen that the heels of the timbers *a a* abut on to an inside keel *c*, which is generally termed a hogging piece; whilst the actual heels of the timbers are joggled into the main keel *d*. The heels of the timbers are bolted through keel and hogging piece. The frames or timbers are further secured to the hogging piece and keel by the iron knee floors *n n*, and the throat of the knee floor carries a long bolt through hogging piece, keel, and lead keel *e*. The garboards are bolted through the main keel, and altogether the structure is made as solid and immovable as if it were one whole piece. In building according to this plan great care is necessary in fitting the heels of the timbers into the joggles in the keel and hogging piece, and equal care is necessary in placing the bolts. Sometimes the heels of the timbers are not joggled to the side of the keel or hogging piece at all, but simply spiked or throughbolted to one or the other, or both. Occasionally the siding of the hogging piece is a little less than that of the main keel, and in such case the heels of the timbers are made to rest on the edges of the top of the keel, which form the stepping line carried fore and aft into the dead wood. Yet another plan of constructing the floors of the vessel is sometimes met with: no hogging piece is used, but the heels of the timbers are so cut or joggled that half rests on the top of the keel and half on the side; the heels are spiked through the keel and secured by iron knee floors, which may be either fitted to the sides of the timbers, as shown in Figs. 17 and 18, or to their inner surfaces, as shown in Fig. 19. (This latter plan will be illustrated further on in describing Lake Windermere yachts.) It would be difficult to say which plan is to be preferred, as each is used where some special object is in quest. For instance, in Fig. 17 we see a vessel with an abnormally broad wood keel, and the keel is so broad solely because she should carry a considerable weight of metal under it; it is manifest that no hogging piece is required here to prevent sagging or hogging, and such an addition to the structure would only be taking up space which would be much better occupied by ballast. Then, as the keel is so broad in its siding, too much or unnecessary displacement might be the result if the heels of the timbers were butted to the side of the keel; hence the heels rest on the top of the keel, and the strength of the structure is insured as shown. In striking the ground there would not be the least possibility of the keel being driven up through the vessel, and all wrenching or twisting strains are amply provided for by the iron knees and transverse plates. So far as Fig. 19 goes, the hogging piece and main keel can be

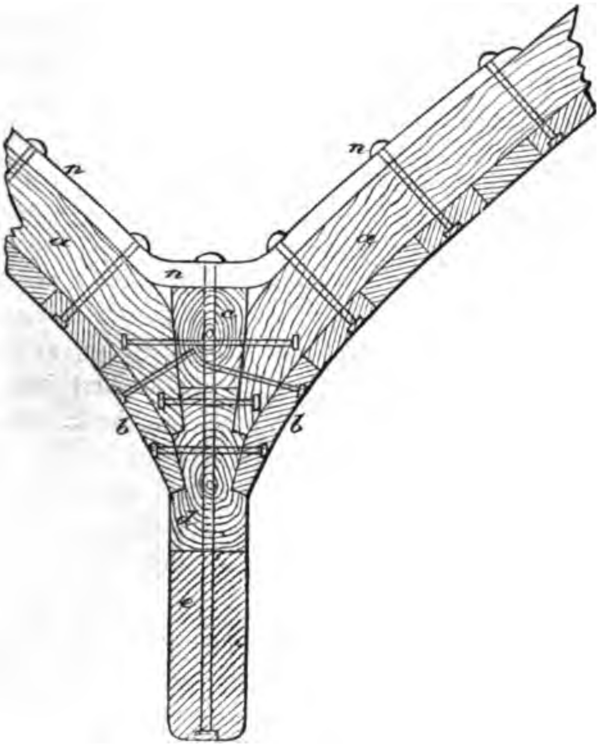

FIG. 19.

regarded as all one piece, strength and rigidity being supplied in depth instead of by breadth, as an object existed in having the lead keel deep in proportion to its breadth. Any chance of the keel going up through the bottom of the vessel is met by the heels of the frames being joggled into it, and by the garboards being rabbeted into it lower down; beyond this there are the iron knee floors, which would have to be crushed or broken, or unfastened, before the keel could make an entry into the hold of the vessel. Next we come to the plan of half joggling the heels of the frames to the top of the main keel; and it is obvious that this plan, if the heels are of sufficient moulded depth, is a very secure one. The plan of having a hogging piece of less siding than a keel, so as to admit of a stepping line for the heels of the timbers, has no advantages over the plan shown by Fig. 19, but is one that might very well be adopted where the hogging piece is of metal. (The Shulah, 20-tonner, and Mildred, 10-tonner, were built in this way with lead hogging piece.)

The plan of butting the heels of timbers to the sides of a keel without any joggles or stepping line whatever has been objected to, because there is a probability of the keel, in case a vessel got ashore and bumped heavily, being driven away from its fastenings. In a vessel with a flat floor this might very likely be the case, as the iron knees would most likely part in their angles at the first heavy bump; in fact, they would have to bear the brunt of the shock. But in the case of a vessel with great rise of floor, as illustrated by Fig. 17 or Fig. 19, the matter is entirely different. Before the keel could make a movement upwards away from the heels of the timbers, the garboards and frame of the planking above would have to give way, to say nothing of the iron knees; and we may conclude that the force that could do this, in the case of a vessel with such a rise of floor as Fig. 17 or 19, would be also capable of breaking up the keel and floor structure of either of the plans named.

Fig. 20 illustrates the old-fashioned orthodox structure of a vessel's floor: *a* is a grown floor, sometimes joggled as shown, and sometimes not, to the main keel *k*. The keelson is shown by *s* and garboard by *g*, bolted through the keel. The keelson floor and keel are bound together by through bolts, as shown by *b*. In many yachts constructed with double timbers, one floor is of cast iron and the other of wood; or one cast-iron floor of the form shown by *a* (Fig. 20) is used (upon the heads of which the heels of the first futtocks rest); and, instead of an accompanying grown floor, the heels of the sister timbers are brought down to, and rest on, the top of the keel. There is no denying the strength of the grown floor and cast-iron floor plan, and the keel would be knocked into sawdust before it would come smashing through the cabin floor.

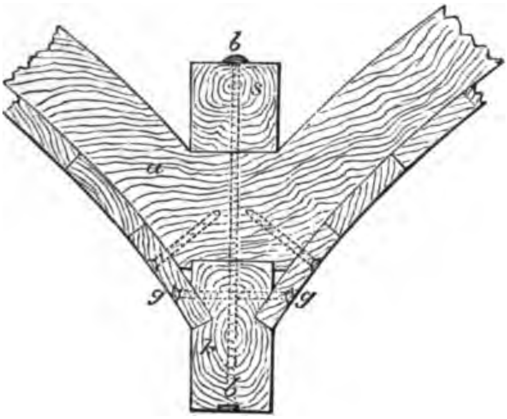

Fig. 20.

The other parts of the vessel, whether large or small, should be constructed according to the recognised practice. However, it is seldom that

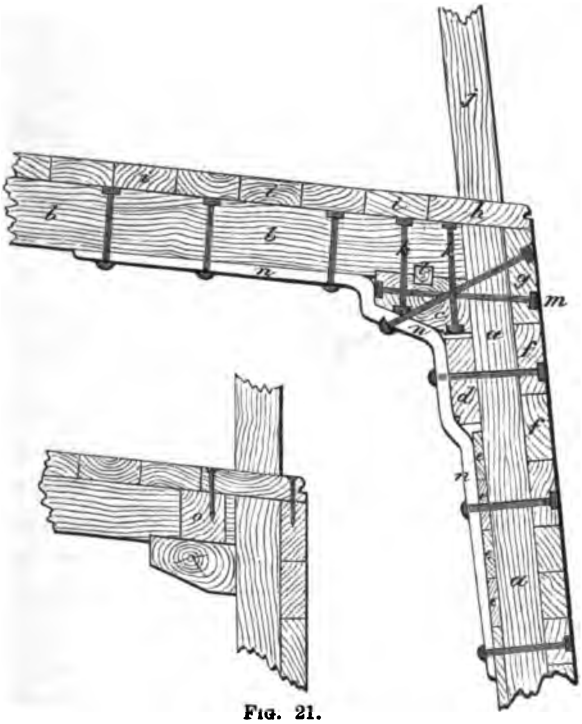

Fig. 21.

a shelf is met with in 10-tonners, a clamp only doing duty as a shelf to take the deck-beams and fastenings and timber-head fastenings. When a clamp only is fitted in a 10-tonner, the top strake (under the covering board) should be of oak, and bolted through timber, clamp and all.

The proper plan of construction for this part of the vessel is shown by Fig. 21; *a* is a timber or frame; *b* a deck beam; *c* the shelf; *d* the clamp; *e* the ceiling; *f* the outside plank; *g* the top strake or sheer strake; *h* the covering board; *i* the deck plank; *j* a stanchion; *k k* bolts through every beam; *l* a dowell; *m* a bolt through every frame; *n* a hanging knee bolted as shown; *o*, in the other sketch, shows a section of pieces of timber fitted between deck beams to take the fastenings of the covering board. Each piece of timber is bolted to the shelf.

The number of hanging knees will depend upon the size of the yacht, and the minimum number allowable is set forth in the Table C, in page 85.

Various plans have been used for strengthening and binding together the fabric of the hull; but the diagonal iron braces previously referred to are only used in large yachts of great length. In yachts of eighty feet and under in length, thick strakes of hard wood or pitch pine are worked under the clamp and shelf, and run the whole length of the vessel, and are through-fastened with metal bolts. Similarly bilge strakes and limber strakes are worked and fastened. The limber strakes are worked over the heels of the first futtocks which join the heads of the floors. A limber strake in a cruising vessel with a floor construction, such as that shown in Fig. 17 or 19, where there is no keelson, would greatly add to the strength of the vessel; but in yachts of 50 tons and under it would scarcely be necessary to have a "thick strake" above the bilge strake. Outside a wale or bend is worked and through-fastened; but where all the planking is of hard wood, the wales are dispensed with.

It must be understood, if the yacht about to be built is intended for racing rather than cruising, that it will be an advantage to reduce the scantling, and increase the spacing so far as may seem compatible with strength. The plank also, from the bilge upwards, can be of red pine instead of teak or oak, and the deck beams can also be of red pine; the bulwarks of red pine, and the stanchions and rails reduced in size so far as may appear consistent with strength. We have existing racing vessels, of similar tonnage, with as much as two-fifths difference in the size and height of stanchions; and in a 200-ton vessel half a ton of weight might very well be disposed of in this way. Of course it is only fair to say that some of our most successful racing vessels, such as Florinda, Corisande, or Gwendolin, are built of the heaviest material and full scantling. However, although this may show that a vessel can be so built and succeed as a racer, it is at least an open question whether she would not have been a still greater success had her scantling been reduced.

The metal fastenings of yachts form a subject about which there is a great deal of opposite opinion. The builder who constructs cheaply stoutly contends that there is nothing like iron; on the other hand, the builder who always asks and gets a good price for his work would as soon think of fastening a yacht with cabbage stumps as with iron. Others recommend iron for dead-wood bolts, shelf bolts, and floor bolts, with Muntz' metal for plank fastenings. Others recommend Muntz' metal for all bolts, and a mixture of Muntz' metal and trenails for plank fastening. There is no doubt that iron has advantages, so far at least as long dead-wood bolts are concerned. Iron can be driven very much tighter than copper rod, and its strength is greater. We have seen iron bolts, that had been made hot and dipped in varnish or oil before they were driven, taken out of a vessel thirty years old, long before galvanised iron was heard of, as clean and bright—in fact, the varnish unperished—as they were at the moment of driving. On the other hand, if the iron were driven through a shaky piece of timber, or loosely driven, so that salt water might get to it, decay of the iron would be very rapid; hence preference must be given to copper or Muntz' metal. Iron is often used for shelf fastenings, and it is less objectionable there; but of course, if the different parts of the frames, shelf, and beams are not nicely caulked or made to fit closely, the bolts may decay. Preference should be given to Muntz' metal for all dead woods, as it can be driven as tightly as iron, and, if of the best quality, will clench as well.

Lloyd's give an additional year to all ships or yachts that are fastened from the keel upwards (to within one-fifth the depth of hold amidships from the deck) with yellow metal or copper bolts and dumps, or trenails; in such case the fastenings for the upper strakes of plank to the deck must be properly galvanised, it being understood that the iron bolts for frames, beams, &c., are to be galvanised. And a further two years are granted if *no trenails* are used at all.* Whether trenails or bolts are used, one is to be put in each plank or strake at every timber; two-thirds of the trenails are required to be driven through, and the butts of the plank must be through-bolted with copper or yellow metal; and the bilge strake and limber strake should be through-bolted.

Trenails are scarcely adapted for vessels of less than 50 tons, on account of the small size of the timbers; and even in these they should be very sparingly used (and only in the bottom plank), as a 3in. timber must be very considerably weakened if it is bored with holes to receive 1in. trenails.

Table B. (page 85) gives the sizes of the necessary fastening for yachts of various tonnages:

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* Lloyd's also give an extra year if the vessel is built under cover.

A

SIZES OF TIMBERS, KEELSON, KEEL, PLANKING, &c.

Tonnage, Y.R.A.	5	10	20	30	40	50	75	100	150	200	250	300
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Timber and Space (double frames)	15	16	17	18	19	20	22	23	24	25½	27	28½
Floors, sided and moulded * at keelson	3	3½	4	4½	5	5½	6	6¾	7½	8	8¾	9½
Futtocks (timbers), sided and moulded at floor heads	2½	3	3½	4	4½	5	5½	6	6¾	7¼	7¾	8½
2nd Futtocks, sided	—	—	3¼	3¾	4¼	4¾	5	5½	6	6½	7	7½
3rd Futtocks and Top Timbers	—	—	3	3½	4	4½	4¾	5	5¼	5¾	6¼	6½
† Top Timbers, moulded and sided at heads	1¾	2	2¼	2¾	3	3¼	3½	4¼	5	5½	6	6¼
Keel, Stem, Apron, and Sternpost, sided and moulded	4	4½	5½	6	7	7½	8½	9	9½	10	10½	11
Keelson, sided and moulded	4½	5	6	7	8	9	9½	10	11	11½	12	12½
Wales, ½ depth of ship	—	—	2¼	2½	2½	2¾	2¾	3	3½	3¾	3¾	4
Bottom Plank, from keel to wales	1¼	1⅜	1½	1¾	1⅞	2	2¼	2¼	2½	2¾	3	3¼
Sheer Strakes at upper edge, Upper Deck Clamp, where no shelf is fitted	1½	1⅝	1⅞	2	2¼	2½	2½	2¾	3	3¼	3½	3¾
Ceiling	½	⅝	¾	⅞	1	1⅛	1¼	1¼	1⅜	1½	2	2
Bilge Plank or Stringer inside, Thick Strakes, over long and short Floor-heads, and Limber Strakes	1¼	1⅜	1½	2	2¼	2½	2½	2½	3	3¼	3¼	3½
Shelf sided and moulded	3	3½	4	4½	5	5½	6	6½	6¾	7¼	7¼	7¾
Planksheer	1½	1⅝	2	2⅛	2¼	2⅜	2½	2½	2⅝	2¾	2¾	3
Flat of Deck	1½	1⅝	2	2⅛	2¼	2⅜	2⅜	2½	2⅝	2¾	2¾	3
Scarph of Keel or Keelson	5ft	5ft 3in	5ft 6in	5ft 9in	6ft	6ft	6ft 3in	6ft 6in	6ft 9in	7ft	7ft	7ft

* Sided means the thickness of the timber between its two straight or flat sides; and "moulded" the thickness between the curved sides.

† The sizes of the timbers should diminish gradually from size at floor head to that of top timber heads.

The butts of plank to have not less than five feet shift, unless two strakes of plank intervene between the two wherein the butts occur on the same timber.

B

Tonnage, R.Y.A.	5	10	20	30	40	50	75	100	150	200	250	300
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Keel, knee, stemson, and deadwood bolts	6/16	7/16	8/16	9/16	10/16	11/16	14/16	15/16	1	1	1 1/16	1 2/16
Bolts, scarphs of keel, arms of breast-hooks, riders, hanging knees to deck beams, and in and out bolts of shelf and clamp	⅜	⅜	6/16	8/16	9/16	11/16	12/16	12/16	12/16	12/16	13/16	14/16
Keelson bolts (on through keel at each floor), throats of transoms, of breast-hooks, and of hanging knees	6/16	7/16	8/16	10/16	11/16	12/16	13/16	13/16	14/16	15/16	15/16	1
Bilge, limberstrake, and through butt bolts	⅜	⅜	7/16	8/16	9/16	9/16	9/16	10/16	10/16	11/16	11/16	12/16
Other butt bolts	⅜	⅜	6/16	7/16	8/16	9/16	9/16	10/16	10/16	10/16	11/16	11/16
Bolts through heels of timbers abutting on sides of dead wood fore and aft	⅜	⅜	8/16	8/16	9/16	10/16	10/16	11/16	11/16	11/16	12/16	12/16
Pintles of rudder (the lower brace must extend not less than 3ft. 6in. from the after part of sternpost in a 100-ton vessel, and in proportion for more or less tonnage)	1¼	1¼	1⅜	1⅜	1½	1⅞	1⅞	2	2	2¼	2⅜	2½
Hardwood trenails	—	—	—	—	⅞	1	1	1	1	1⅛	1⅛	1⅛

Bolts in scarphs of keel to be of copper or yellow metal, and not more than 1ft. apart.

C

NUMBER OF HANGING KNEES.

Tons.	Hold Beams.	Upper Deck Beams.	Tons.	Hold Beams.	Upper Deck Beams.
	PAIRS.	PAIRS.		PAIRS.	PAIRS.
5	—	3	75	—	6
10	—	3	100	3	7
20	—	4	150	4	9
30	—	4	200	6	11
40	—	5	250	8	13
50	—	5	300	10	15

D

ANCHORS FOR SAILING YACHTS.

Yacht Tonnage.	Number of Anchors.	1st Anchor.		2nd Anchor.		3rd Anchor.		4th Anchor.	
		Weight.	Test.	Weight.	Test.	Weight.	Test.	Weight ex. Stock.	Test.
		Cwts.	Tons.	Cwts.	Tons.		Tons.	Cwts.	Tons.
5	2	With Stock ¾	—	With Stock ½	—	—	—	—	—
10	2	With Stock 1	—	With Stock ¾	—	With Stock 20lb.	—	—	—
20	2	With Stock 1½	—	With Stock ¾	—	With Stock 35lb.	—	—	—
30	2	Ex. Stock 1¼	3 18/20	With Stock 1	—	With Stock 50lb.	—	—	—
40	2	2	4 13/20	With Stock 1¼	—	With Stock ½cwt.	—	—	—
50	3	2½	5	Ex. Stock 2¼	4 15/20	With Stock ¾	—	—	—
60	3	3	5 18/20	2¾	5 5/20	With Stock 1	—	—	—
75	3	3½	6 3/20	3¼	5 18/20	With Stock 1¼	—	—	—
100	3	4½	6 17/20	4¼	6 13/20	With Stock 1½	—	—	—
125	3	5	7 7/20	4¾	7 3/20	Ex. Stock 1½	4 4/20	—	—
150	4	5½	7 18/20	5¼	7 11/20	2	5	1	—
200	4	6½	8 13/20	6	8 5/20	2½	5 5/20	1	—
250	4	7	9 6/20	6½	8 15/20	3	5 10/20	1½	—
300	4	8	10 3/20	7½	9 13/20	3½	5 15/20	2	4 10/20

Some anchors, such as Cole's, are carried about 20 per cent. less in weight than given in the table.

CHAINS FOR SAILING YACHTS.

Tonnage.	Chain Cable.			Stream Chain.			Hawser.		Warp.	
	Minimum Size.	Test.	Breaking Test.	Length.	Length.	Size	Length.	Size.	Length.	Size.
	Ins.	Tons.	Tons.	Fathoms.	Fathoms.	Ins.	Fathoms.	Ins.	Fathoms.	Ins.
5	5/16	—	—	50	—	—	40	3½	40	2½
10	7/16	3 7/16	5⅛	60	—	—	45	4	45	3
20	8/16	4 8/16	6¾	60	—	—	50	4½	45	3
30	9/16	5 11/16	8½	60	—	—	60	4½	45	3
40	10/16	7	10½	75	—	—	60	5	50	3
50	10/16	7	10½	90	—	—	75	5	60	3½
60	11/16	8 8/16	12¾	105	—	—	75	5½	75	3½
75	11/16	8 8/16	12¾	120	—	—	75	5½	75	3½
100	12/16	10⅛	15¼	135	—	—	75	6	90	3½
125	12/16	10⅛	15¼	150	45	9/16	75	6	90	4
150	13/16	11⅞	17 13/16	150	45	9/16	75	6	90	4
200	14/16	13¾	20⅝	150	45	9/16	75	6½	90	4
250	15/16	15 13/16	23 11/16	165	45	9/16	75	6½	90	4½
300	1	18	27	165	45	9/16	75	7	90	4½

Some ten years ago it seemed likely that composite vessels would quite supersede those entirely of wood construction; but so far the composite plan has not advanced in favour. This is really a matter for surprise, as the composite build offers this advantage over the wood structure: so very much more room is obtainable inside on the same weight or displacement. The great question was ten years ago, could a composite vessel be so fastened as to be insured against the possibility of the fastenings giving out? We think the question has now, after ten years, been satisfactorily answered by such vessels as Oimara, Selene, Nyanza, or Garrion, built by Steele and Co., of Greenock; the Sunbeam and Modwena, built by Bowdler and Chaffler, at Liverpool; the Bella Donna and Seabird, built by Hatcher; and many others. None of these vessels have, so far as we know, ever shown the slightest signs of straining, nor have their fastenings decayed; in fact, so far there seems every chance of their out-enduring any of the wood yachts which were constructed at about the same period. For a composite yacht it is best that all the planking (excepting, of course, the deck) should be of hard wood, and that the plank fastenings should be of Muntz' metal screw bolts sunk in the plank, and so insulated that galvanic action could not be set up with the outside copper, the bolts, and the frames. Mr J. S. White, of East Cowes, has, within the last two years, provided the necessary plant for composite construction, and has built two large yachts according to that system of construction; and at Gosport Messrs Hodges and Trevithick have a similar plant for composite building. We may perhaps take this as evidence that composite vessels are gradually coming into general use.

Lloyd's have recently compiled a table of scantlings for iron yachts, and will in future class such as are built up to their rules. Steel, however, is likely to supersede iron, as Lloyd's will give the same class for one-fifth less weight.

A great many experiments have from time to time been made with compositions for preventing the fouling of the bottom of ships; but up to the present time no specific has been discovered, and the opportunity for someone to realise a large fortune still exists. So far as yachts are concerned, they are generally sheathed with copper; and, for these waters at least, the bottom can be kept clean enough by a couple of scrubbings throughout the season. One of the compositions, such as Jesty's, Day's, Peacock's, or Martin's, is sometimes put over the copper; but, for racing at least, we prefer the copper without the composition, as clean copper has a smoother surface than either of the compositions imparts. Of course, for a racing yacht, the copper cannot very well be cleaned too often; and a month is quite long enough for the vessel to be without a scrub, although there are but few who get one so often. The Admiralty have been making some experiments with zinc as a sheathing for iron ships (the iron being first protected by a slight wood skin), but so far zinc does not appear to offer many advantages. Copper, on the other hand—if the ship be kept constantly moving, or moored, say, in a five-knot tide—will keep comparatively clean, on account of the extensive exfoliation which goes on of the oxychlorides and other soluble salts produced by the action of the salt water on the copper. Oxychlorides are similarly and much more rapidly formed on zinc, but are not so readily soluble; hence very little exfoliation takes place, and a corroded and rough surface is the result, the zinc being finally eaten through. Zinc, therefore, we may conclude, is unsuitable as a sheathing for yachts, especially as evidence exists that such sheathing ⅛in. thick has been eaten through in one year. An alloy of copper (2) and zinc (3), popularly known as Muntz' metal, is largely used as a sheathing for ships; but it is scarcely so good as copper for yachts, as, owing to its greater stiffness, it cannot be laid so well. Another objection to Muntz' metal sheathing is that it does not exfoliate to the extent copper does, and that after being under the influence of salt water any considerable time—say three or four years—the metal becomes rotten; but this defect, it is said, can be remedied by an addition of a small quantity of tin to the alloy. For composite ships Muntz' metal sheathing has some advantage, as it sets up very little, if any, galvanic action with iron; but the risk of galvanic action from copper sheathing in a well-constructed composite ship is so remote that copper is to be preferred even for these, if the difference in cost is not a consideration.

A curious feature in connection with yacht construction is that naval architects should have had so little to do with the designing of yachts. Yacht builders, as a rule, keep draughtsmen, who are instructed as to a design, and thus the builder becomes his own architect. That this plan has succeeded there can be no doubt, and it might even be questioned whether an architect could at present compete with the builder, if the latter bestowed so much time on a design as he ought. But, as a rule, builders are too much occupied with the cares of their business to devote much time to the mathematical consideration of a design; and it is only their experience, and a prudent purpose not to depart in any radical way from a model which practice has proved to be possessed of undeniable good qualities, that keep them from blundering into failure. If we were asked to give a reason why the business of designing happens to be in the same hands as the business of building, we could give no satisfactory answer, if a true one. The truth is that, in the early days of yachting, a naval architect who confined the exercise of his talents to the designing of yachts would have found his occupation by no means a lucrative one; and perforce the builders were compelled to do their own designing, mostly on the pattern of Government cruisers, with such trifling alterations as their experience permitted them to venture upon. Occasionally gentlemen took to model-making, and two of them (Mr. Joseph Weld and Mr. T. Assheton Smith), it must be admitted, had a fair share of success; it is even claimed for Mr. Smith that he invented or discovered the value of "wave lines" before Mr. Scott Russell did. But, be this as it may, there can be no doubt that he was as clever at designing as the professional builders of the day. So builders were compelled to do their own designing, because the profession of a yacht-naval architect would simply have been starvation. But if builders as a matter of necessity did their own designing fifty years ago, it can scarcely be said that a similar necessity exists now, although the custom does. During the last ten years there have been, on the average, fifty vessels of all rigs and sizes built every year, and it might be assumed that the emoluments for designing these would keep a goodly number of naval architects in the necessaries of life. The few who have made yacht-naval architecture a study and profession have undoubtedly succeeded well enough to lead to the conclusion that, with more opportunities, they would make a very considerable advancement in yacht design. Builders would be relieved of a great source of anxiety, as the responsibility of a vessel answering the requirements or expectations of the person for whom she was built would be shifted from their shoulders to those of the architect. Such a shift of responsibility would unquestionably be an advantage for the yacht owner, as it is much more likely that a scientifically trained architect, who has opportunities of tracing causes of success or failure, would achieve any given object than that a builder would, whose business occupations necessarily restrict the exercise of his attention and experience on the important work of designing. It is, therefore, satisfactory to note that yacht designing is gradually gaining recognition as a profession; and if improvement is to be made in the form of yachts, we must look for it from the hands of professional yacht designers.

CHAPTER XII.

THE EQUIPMENT OF THE YACHT.

The equipment of a yacht embraces generally everything that is used or required for working her. Usually it is understood to consist of the spars, rigging, sails, and various tackles or purchases, anchors, chains, warps, boats, lights, &c. The diagram, Plate 1, and the references, will assist the explanations that will follow of the various parts and uses of a vessel's outfit or equipment.

Sails.

A. Mainsail.
a. Clew of mainsail, with traveller on the horse 13 (chain outhaul and tackle shown underneath boom).
b. Main tack.
c. Throat.
d. Peak earing.
e. Head.
f. Foot and roach of sail
g. Luff or weather leech.
h. Leech, or after leech.
i. First, second, third, and close reef cringles.
j. First, second, third, and close reef points.
k. First, second, third, and close reef cringles or luff cringles.
B. Foresail.
a. Luff.
b. Foot.
c. Leech.
d. Head.
e. Tack.
f. Reef points.
C. Jib.
a. Luff.
b. Foot.
c. Leech.
d. Head.
e. Tack.
D. Gaff Topsail.
a. Clew.
b. Tack.
c. Weather earing, or head earing.
d. Peak earing.
e. Head.
f. Foot.
g. Luff.
h. Leech.
E. Jib Topsail.
a. Luff.
b. Foot.
c. Leech.
d. Head.
e. Tack.

Spars.

1. Mast.
2. Top Mast.
3. Bowsprit.
4. Boom.
5. Gaff.
6. * Topsail yard.
7. Spinnaker boom.
8. Hounds, bolster, and yoke.

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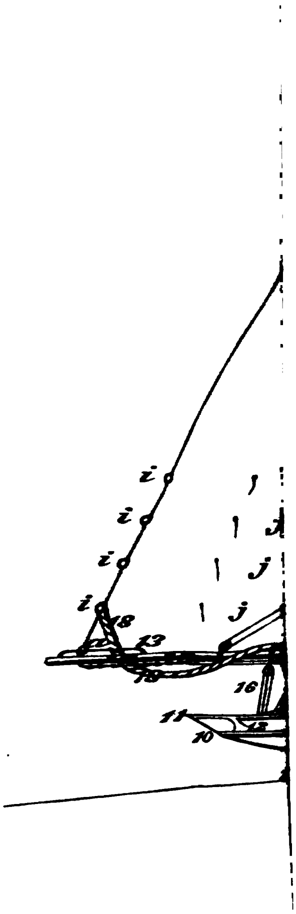
* Formerly balloon topsails, with a footyard or jackyard, were very common in racing yachts; they are now generally done away with, excepting in schooners and yawls, as they greatly increase the weight aloft, without much increasing the size of topsail.

PLATE :



Spars—*continued*.

9. Cap.
10. Masthead.
11. Pole of topmast.
12. Truck.
13. Iron horse at boom end for mainsail outhaul to travel on.
14. Mast hoops.

Rigging.

1. * Main rigging, shrouds.
2. * Sheer pole, termed also sheer batten and sheer stretcher.
3. * Dead eyes and lanyards.
4. * Fore stay.
5. * Pendant.
6. * Runner.
7. * Runner tackle.
8. * Fall of runner tackle.
9. Topmast stay (topmast back-stays or shrouds not shown.)
10. Topmast shifting backstay, or "preventer backstay."
11. Tackle of shifting backstay.
12. * Bobstay.
13. Bobstay tackle and fall.
14. Main halyards.
15. Peak halyards.
16. Main sheet.
17. Topping lifts.
18. Reef-earing or pendant.
19. Foresail halyards.
20. Foresail sheet bent to clew of sail.
21. Foresail tack.
22. Jib halyards.
23. Jib sheets fast to clew of sail.
24. Jib tack.
25. Jib traveller.
26. Jib outhaul.
27. Jib downhaul and foresail downhaul.
28. Topsail halyards.
29. Topsail upper halyards, or tripping halyards.
30. Topsail sheet, leading through block on pendant, fast round masthead.
31. Topsail tack.
32. Topsail tack tackle.
33. Topsail clew line.
34. Jib-topsail halyards.
35. Jib-topsail tack.
36. Jib-topsail sheet, fast to clew of sail.
37. Mainsail downhaul.
38. Spinnaker-boom topping lift.
39. Spinnaker-boom after guy.
40. Spinnaker-boom hauling and standing parts of whip purchase of after guy.
41. Spinnaker-boom fore guy.
42. Spinnaker outhaul, the hauling part on the under side of the boom.
43. Spinnaker outhaul, on the upper side of boom, the part made fast to spinnaker tack.

The parts of the rigging marked thus * are termed "standing rigging," and the other parts "running rigging."

Hull.

1. Load water-line. (L.W.L.)
2. Keel.
3. Sternpost.
4. Rudder.
5. Deadwood.
6. Forefoot, termed also gripe.
7. Stem.
8. Freeboard.
9. Counter.
10. Archboard.
11. Taffrail.
12. Quarter timbers.
13. Covering board or plank sheer.
14. Rail, or rough tree rail.
15. Channel.
16. Chain plates, or channel plates.
17. Bobstay shackle plates.

FIG. 22.

Hull.

1. Floor.
2. Frames or timbers.
3. Keel.
4. Garboard.
5. Bilge.
6. Deck.
7. Deck beam.
8. Bulwark staunchions.
9. Channels and channel plates.

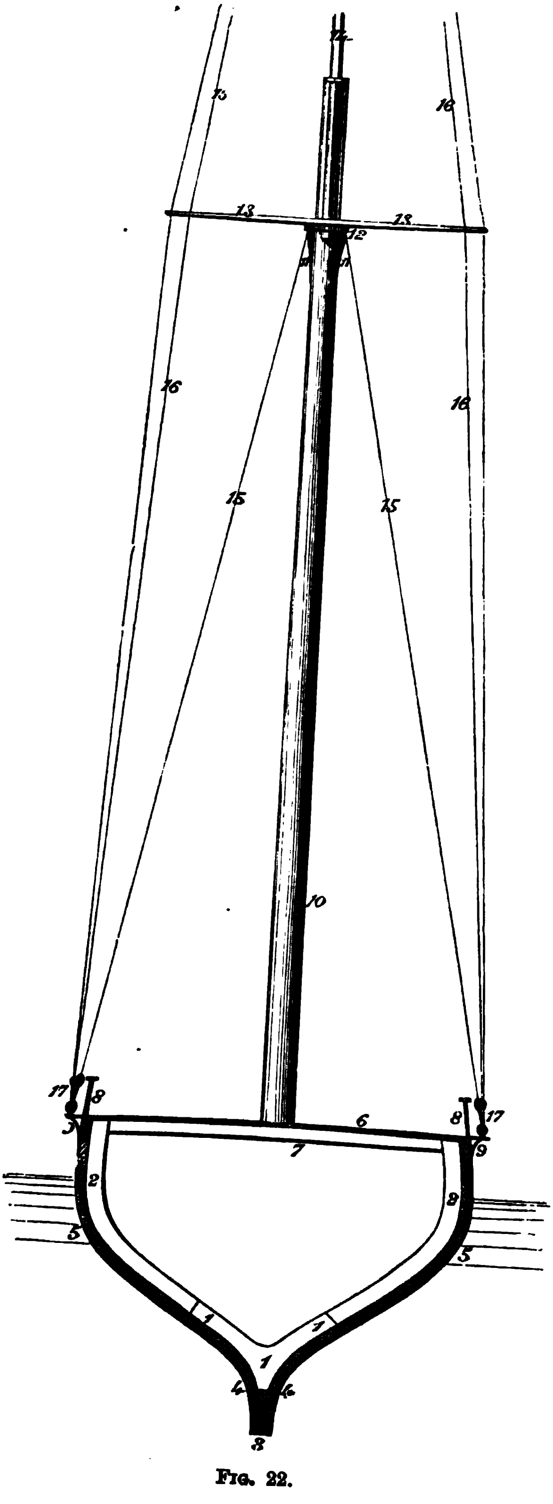


FIG. 22.

Mast and Rigging.

10. **Mast.**
11. **Hounds.**
12. **Yoke or lower cap and bolster.**
13. **Crosstrees.**
14. **Topmast.**
15. **Main rigging or shrouds.**
16. **Topmast shrouds or backstays.**
17. **Backstay falls or tackles.**

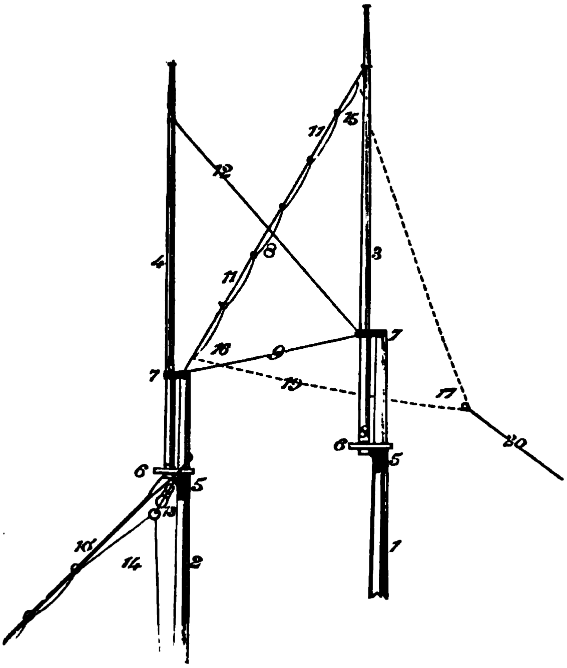


FIG. 23.

1. **Mainmast.**
2. **Foremast.**
3. **Main topmast.**
4. **Fore topmast.**
5. **Hounds or cheeks of mast.**
6. **Lower cap on which crosstrees rest, fore side of topmast.**
7. **Cap.**
8. **Topmast fid.**
9. **Triatic stay.**
10. **Forestay.**
11. **Main-topmast stay.**
12. **Fore-topmast backstay.**
13. **Fore-staysail halyards.**
14. **Head of fore-staysail.**
15. **Head of main-topmast staysail.**
16. **Tack " "**
17. **Clew " "**
18. **Luff " "**
19. **Foot " "**
20. **Sheet leading to quarter rail.**

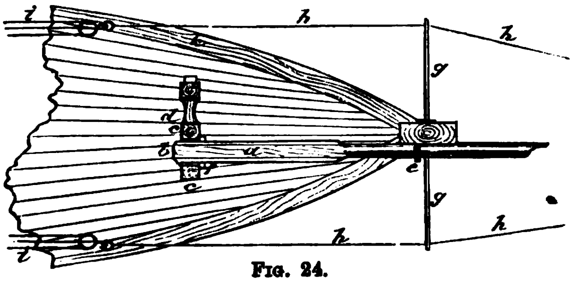


FIG. 24.

FIG. 24.

a. The bowsprit.
b. Heel of bowsprit.
c. Bitts.
d. Windlass.
e. Gammon iron, called also span shackle.
f. Fid.
g. Whiskers.
h. Wire shrouds.
i. Tackle for setting up shrouds. N.B. The block is usually an iron fiddle one here.
k. Covering board.

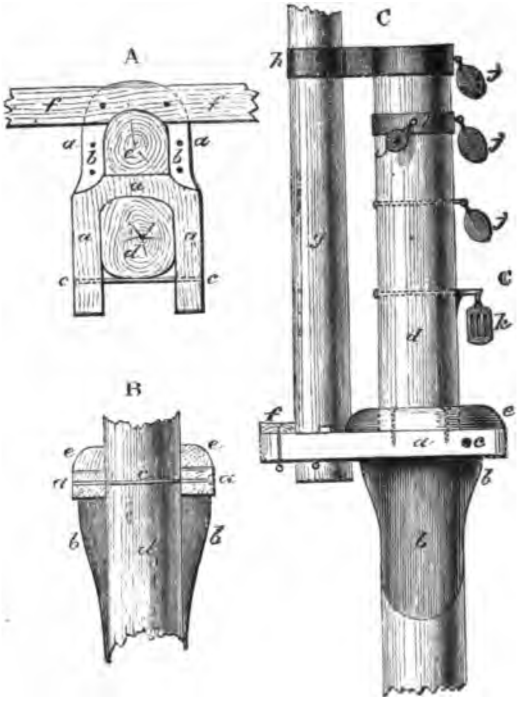


FIG. 25.

MASTHEAD FITTINGS.

Fig. A shows a view of the top side of the yoke or lower cap.
a is the yoke.
b is a U-shaped iron plate fitted over the yoke in front, where the topmast passes through.
c is an iron bolt at the aft side of mast.
d is the mast.
e is the topmast.
f the crosstrees fitted on the fore side of topmast as shown.

Fig. B is the yoke and mast viewed from aft.
a, the ends of the aft arms of yoke.
b, the hounds.
c, iron bolt at aft side of mast.
d, the mast.
e, bolsters on which the rigging rests.

Fig. C shows a broadside view of the yoke and masthead.
a, the yoke.
b, the hounds.
c, iron bolt at aft side of mast.
d, the masthead.
e, bolster.
f, crosstrees.
g, topmast.
h, iron cap.
i, jib-halyard block (one on each side of mast, on iron hoop).
j, peak-halyard block.
j, " "
j, " "
k, Main-halyard block, bolt, and spur. This bolt should be long enough to keep the parts of the halyards clear of the yoke, and be supported by a strong spur below. Sometimes a stay above is also fitted.

TABLE OF SIZES OF BLOCKS FOR YACHTS OF VARIOUS SIZES.

IRON STROP BLOCKS.

NAME OF BLOCK.	Description.		5 Tons.	10	15	20	30	40	60	80	100
	Number. Double.	Number. Single.	Size.	Size.	Size.	Size.	Size.	Size.	Size.	Size.	Size.
			Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Main halyards *a*	2	—	4½	5	5½	6	7	8	9	9½	10
Peak halyards	—	5	4½	5	5½	6	7	8	9	9½	10
Mainsheet	1	1	4½	5	5½	6	7	8	9	9½	10
Mainsheet lead	—	2	3	4	4½	5	5½	6	6½	7	7½
Jib halyards	—	3	4½	5	5½	6	7	8	9	9½	10
Fore halyards	—	2	3	4	4½	5	6	6½	7	7½	8
Bobstay (iron blocks)	1	1	4½	5	5½	6	7	8	9	9½	10
Bowsprit shrouds *b*	2	2	6 & 3	6½ & 4	7 & 4½	7½ & 5	8 & 5½	8½ & 6	9 & 6½	9½ & 7	10 & 7½
Pendant blocks	—	2	3½	4	4½	5	5½	6	6½	7	7½
Runner (fiddles)	2	2	6	6½	7	7½	8	8½	9	9½	10
Main outhaul	—	1	3	3½	4	4½	5	5½	6	6½	7
Topsail sheet	—	1	2½	3½	4	4½	5	5½	6	6½	7
Topmast backstays *c*	4	4	3	3½	4	4½	5	5½	6	6½	7
Preventer backstays	2	2	3	3½	4	4½	5	5½	6	6½	7
Preventer backstay whips	—	2	—	3½	4	4½	5	5½	6	6½	7
Jib tack	—	1	—	3½	3½	4	4½	5	5½	6	6½
Jib purchase	1	1	3½	3½	4	4½	5	5½	6	6½	7
Jib purchase runner	—	1	—	—	—	—	—	5	6	7	8
Main purchase	1	1	3½	3½	4	4½	5	5½	6	6½	7
Peak purchase	1	1	3½	3½	4	4½	5	5½	6	6½	7
Topping lifts	—	2	3½	—	4	4½	5	5½	6	6½	7
Topping lift purchase	—	4	3	3½	4	4½	5	5½	6	6½	7
			ROPE STROP BLOCKS.								
Jib topsail halyards	—	2	3	3½	4	4½	5	5½	6	6½	7
Spinnaker halyards	—	1	3	3½	4	4½	5	5½	6	6½	7
Spinnaker guy whip	—	1	—	3	3½	4	4½	5	5½	6	6½
Spinnaker topping lift	—	2	3	3½	4	4½	5	5½	6	6½	7
Trysail sheets	2	2	4½	5	5½	6	6½	7	7½	8	8½
Fore sheets	—	4	3½	4	5	5½	6	6½	7	7½	8
Reef-tackle (fiddle)	1	1	6 & 3½	6½ & 4	7	7½	8	8½	9	9½	10
Boom guy	1	1	—	3	3½	4	4½	5½	6½	7	7½
Tack tackles	3	3	3	3½	4	4½	5	5½	6	6½	7
Burton	—	2	—	3	4	4½	5	5½	6	6½	7
Gaff topsail sheet whip	—	1	—	3½	4	4½	5	5½	6	6½	7
Down-hauls (forward)	—	3	—	3	4	4½	5	5½	6	6½	7

(*a*) In vessels of twenty tons and over, the upper throat halyard block is a threefold, as one part of the halyards is required for the purchase, and another for the hauling part.

(*b*) These double blocks on the bowsprit shrouds are fiddles.

(*c*) A five-tonner has only four single blocks for backstays, two on each side.

TABLE OF SIZES OF CORDAGE FOR YACHTS OF VARIOUS SIZES.

Name of Rope.	5 Tons.	10	15	20	30	40	60	80	100
	Cf.	Cf.	Cf.	Cf.	Cf.	Cf.	Cf.	Cf.	Cf.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Main halyards	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
Peak halyards	1¾	[illegible]	2¼	2½	2¾	3	3¼	3½	3¾
Mainsheet	1½	1¾	2	2¼	2½	2¾	3	3¼	3½
Jib halyards	5/16	5/16	¼	5/16	⅜	⅜	7/16	½	⅝
Fore halyards	1½	1½	1¾	1¾	2	2¼	2½	2¾	3
Bobstay tackle	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
Bowsprit shrouds tackle	1¼	1½	1½	1¾	2	2¼	2½	2¾	3
Pendant blocks	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
Runner (fiddles)	1½	1½	1¾	1¾	2	2¼	2½	2¾	3
Main outhaul	1	1¼	1½	1½	1¾	2	2¼	2½	2¾
Reef pendants	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
Topsail sheet	1½	1½	1¾	2	2¼	2½	2¾	3	3¼
Topmast backstays	1¼	1¼	1½	1½	1¾	2	2½	2¾	3
Preventer backstays	1¼	1¼	1½	1½	1¾	2	2½	2¾	3
Preventer backstay whips	—	1¼	1½	1½	1¾	2	2½	2¾	3
Jib tack	1¾	2	2¼	1½ w	1½ w	1¾ w	2 w	2¼ w	2½ w
Jib purchase	1¼	1¼	1½	1½	1¾	1¾	2	2¼	2½
Jib purchase runner	—	—	—	—	—	1½ w	1¾ w	2 w	2¼ w
Main purchase	1¼	1¼	1½	1½	1¾	1¾	2	2¼	2½
Peak purchase	1¼	1¼	1½	1½	1¾	1¾	2	2¼	2½
Topping lifts	1¾	2	2½	2¾	3	3¼	3½	3¾	4
Topping lift purchase	1¼	1¼	1½	1½	1¾	1¾	2	2¼	2½
Jib topsail halyards	1¼	1¼	1½	1½	1¾	1¾	2	2¼	2½
Spinnaker halyards	1¼	1¼	1½	1½	1¾	1¾	2	2¼	2½
Spinnaker guy whips	1¼	1¼	1½	1¾	2	2¼	2½	2½	2¾
Spinnaker topping lift	1¼	1¼	1½	1½	1¾	1¾	2	2¼	2½
Trysail sheets	1¼	1¼	1½	1¾	2	2¼	2½	3	3¼
Fore sheets	1¼	1¼	1½	1¾	2	2¼	2½	3	3¼
Reef tackle (fiddle)	1	1¼	1½	1½	1¾	1¾	2	2¼	2½
Boom guy	1	1¼	1½	1½	1¾	1¾	2	2¼	2½
Tack tackles	1	1¼	1½	1½	1½	1¾	1¾	2	2¼
Burton	—	—	1½	1½	1¾	1¾	2	2¼	2½
Gaff topsail sheet whip	—	—	—	1¼	1¼	1½	1½	1¾	1¾
Down-hauls (forward)	—	—	—	1¼	1½	1½	1¾	2	2

(w) Wire jib tack and jib purchase runner. Cf. Circumference.

In the case of jib halyards the size of the iron of the link is given.

CIRCUMFERENCE IN INCHES OF WIRE FOR STANDING RIGGING.

Name.	Tons.								
	5	10	15	20	30	40	60	80	100
Shrouds	1¼	1⅜	1½	1⅝	2¼	2½	3	3	3½
Pendants	1¼	1⅜	1⅝	2	2¼	2½	3¼	3½	3¾
Bowsprit shrouds	1¼	1⅜	1⅝	2	2¼	2½	2¾	3	3¼
Forestay	1⅜	1¾	2	2¼	2½	2¾	3¼	3½	3¾
Bobstay pendant	1⅜	1¾	2	2¼	2½	2¾	3¼	3½	3¾
Topmast stay	¾	¾	1	1	1¼	1½	1⅝	2	2¼
Topmast backstays	¾	¾	¾	1	1¼	1½	1⅝	2	2¼
Topmast preventer backstay	¾	¾	1	1	1¼	1½	1⅝	2	2¼
No. of shrouds a side	2	2	3	3	3	3	3	4	4
No. of backstays a side	1	1	2	2	2	2	2	2	2
Copper bobstay bar*	⅝	¾	⅞	1	1¼	1⅜	1½	1¾	2

STANDING RIGGING.

Main Rigging.

The most satisfactory plan of measuring off the rigging for a yacht is to make a "spar plan" to scale—that is, a plan showing a broadside view of the yacht with all her spars in their places, as shown by Plate 1 and Fig. 22. The latter plan, Fig. 22, is necessary to obtain the correct lengths of the lower-mast shrouds and topmast backstays, as merely taking the length deck to hounds makes no allowance for the "spread" the rigging is to have. (Of course an elaborate drawing is not required, but the scale must be carefully adhered to.) A further allowance must be made for the eyes of the rigging going one over the other, and this allowance will be equal to twice the diameter of a shroud. For instance, the eye of the starboard fore shroud is put over the masthead first; then the port fore shroud, which follows, must be cut longer than the starboard rigging to the extent of twice the diameter of a shroud (twice the diameter is equal to two-thirds of the circumference, the circumference being three times the diameter). For the second starboard shroud, which goes on next, the allowance will be four times the diameter; and so on. (The forestay goes over all.) For the eye and splice an allowance equal to one and a half the circumference of the masthead must be made; for the dead-eye an allowance equal to one and a half the circumference of the same. The eye to go over the masthead should be one and a quarter the circumference of the same at the hounds; the eye at the other end of the shroud should be one and one-eighth the circumference of the dead-eye, so that the latter could be removed if split or damaged, and replaced. The length for each shroud is measured from the top of the bolster to the dead-eyes; the drift or space between the upper and lower dead-eyes, or from the channel to the top of the upper dead-eye, will be about the height of the bulwark.

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* The eyes in the bobstay bar must not be welded or braised. The ends of the bar should be heated and hammered back by striking the end of the bar on the anvil end on; when the end is driven up twice as thick as the other part of the bar, the hole can be drilled or punched—drilling is to be preferred.

There are two plans for fitting the shrouds, one known as "single eye," and the other as "pairs." In the former plan each shroud has its own eye; but when shrouds are fitted in pairs the wire goes from one dead-eye up round the masthead, and down to the next dead-eye (on the same side). A seizing close up to the bolster, round both shrouds, forms the eye. This is the old-fashioned plan, and the one still followed in ships, we believe. The objection to it is that if the eye bursts a pair of shrouds are gone; and even if one shroud burst, the strain on the remaining one will generally draw it through the seizing so as to make it useless. All that can be said in favour of the "pair" plan is that there are just half the number of eyes to go over the masthead, and consequently there is a trifle less weight aloft and a neater-looking masthead.

There are three plans in use for covering the eyes of rigging; 1. Parcelling and serving with spun yarn; 2. Covering with canvas and painting it; 3. Covering with leather.

The first plan is cheapest, but will require renewing every year; the third is the most costly, and lasts the longest; whilst the second is most used, and perhaps looks the neatest. The eyes at the lower ends of the shrouds are generally served with spun yarn; but leather looks neater, and will not turn white, as spun yarn will, by the continual washing whilst dragging through the water; an occasional blacking or varnishing will remove the washed-out appearance that a spun-yarn serving might get.

The lanyards are rove in this manner: A Matthew Walker, or wall knot, is made in one end of the lanyard; the other end is rove *out* through the foremost hole of the upper dead eye; in through the corresponding hole of the lower dead eye; out through the centre hole of the upper dead eye, and so on, the hauling part coming in through the aftermost hole of the lower dead eye and is then set up by a luff upon luff tackle.

Wall knots and Matthew Walkers have, however, been known to draw, and now the practice in racing vessels is to have an eye spliced in one end of the lanyard, which eye is shackled to an eye bolt in the channel rather ahead of the foremost chain plate; the other end of the lanyard is rove *out* through the foremost hole of the upper dead-eye (always commencing with the starboard fore shroud) *in* through the corresponding hole of the lower dead-eye, and so on; passing round the aft side of mast, and ending with the port fore shroud: on the port side the lanyard is shackled to the channel under the after hole of the upper dead-eye.

Very great care must be taken in setting up rigging so that an equal strain is brought on all its parts.

Yachts of from 5 to 15 tons usually have two shrouds a side; those from 20 to 80 tons three shrouds a side; and those above 80 tons four shrouds a side.

When wire rigging was first introduced, great objection was taken to it, on account of its rigidity; and it was declared that the elasticity afforded by the lanyards would never compensate for the lost elasticity of the hemp shrouds. Various plans were suggested to supply the deficient elastic quality of wire rigging, such as spiral spring lanyards, and screw lanyards with indiarubber buffers.* The fact is, however, that the elasticity sought to be given to the wire rigging is not required, and indeed would be a great source of danger. Mr. W. John, in his elaborate report to Lloyd's Committee in 1877 on the dismasting of ships, shows the very considerable elasticity that wire rope has, and the general elasticity of wire shrouds and hemp lanyards combined. From his report we learn that the stretch wire rope is capable of before breaking is very considerable, and that not half of that stretch

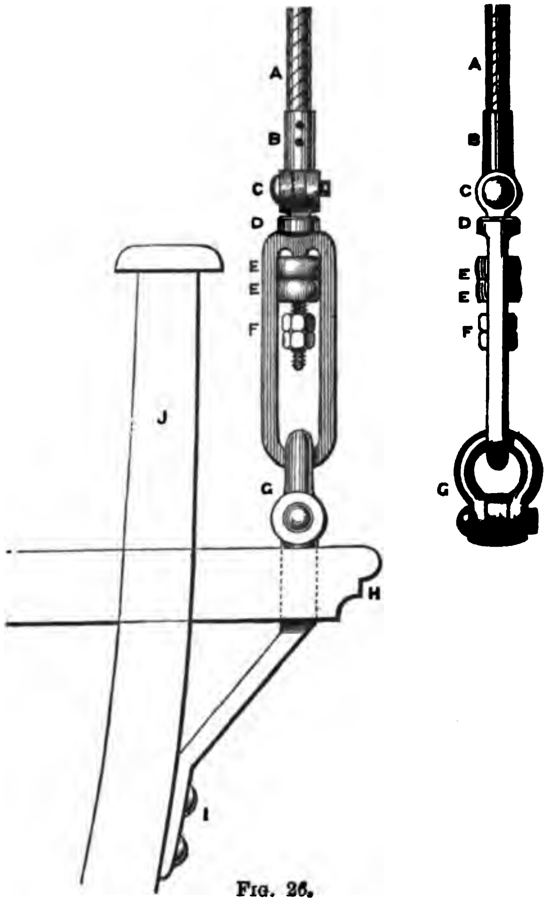

Fig. 26.

*** The late Captain Keane, of East Cowes, proposed the following plan for elastic lanyards in the *Field*, of March 15th, 1873: A (Fig. 26) is a shroud; B, shod, to be made of good length to prevent stripping, or an eye could be turned in to take a shackle; C, a bolt; D, a collar to receive the bolt for screw nuts; E, india rubber buffers of the required number and size; F, screw nuts (two in number), to prevent stripping; G, shackle; H, channel; I, chain plate; J, bulwark.**

and strength would be exhausted when the mast had arrived at its breaking point, due to bending.*

Thus so far there is little danger that a yacht's spars will be lost in consequence of the wire rigging giving out; and, as in ships it is found that if a mast is so lost, it is generally through some defective ironwork or careless fitting of the rigging.

It has been contended that a yacht's main rigging should be elastic, because, if she were sailing in squalls or under the influence of successive shocks of wind force, if the rigging did not give to some extent, it would be like attempting to drive a railway train by a succession of blows from a sledge hammer. In stating the case thus ludicrously the fact is entirely overlooked that a vessel's heeling facility affords much greater relief to such shocks than could the elastic property of any rigging, unless indeed the latter were to be so stretchable as to be perfectly useless for stays. In fact, Mr. John clearly shows in his report that, so far as safety goes, the rigging cannot be set up too rigidly, and the less it stretches the better. It was found that in very heavy weather with a ship rolling and pitching heavily, three-fourths of the ultimate strength of the mast and rigging might be tried at any one moment, and that a succession of such trials would inevitably end in disaster. On this subject Mr. John says: "The margin of strength found to exist in the masts and rigging, to meet the heavy strains arising from heavy weather, is so small that every inducement should be offered to builders and owners to increase the support afforded to the masts, and especially when it is known that so much good can be done in this direction, without adding to the top weight, by simply reducing the elasticity of the shrouds. Wire rigging set up by screws unquestionably affords the most suitable and efficient support to iron masts; and it is to be hoped that the practice of adopting them, which has been growing up lately, will extend, and become far more general than heretofore. Where hemp lanyards are adopted the drift between the dead eyes should be reduced to a minimum, and they should be most carefully kept set up. Bobstays, it is considered, should be increased in size, and all eye bolts, pins, and shackles connected with them should be fitted with the greatest care *and of a strength at least equal to that of the bobstay.*"

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* Mr. W. John, in his report, gives the following formula for ascertaining the breaking strain in tons of wire rope. The square of the circumference of the rope in inches, multiplied by 1·034; that is to say, if the rope be 2in. in circumference, the breaking strength will be $2 \times 2 \times 1{\cdot}034 = 4{\cdot}13$ tons, or about 25 per cent. less than authorities on the subject have usually given. The size of steel wire of equivalent strength is generally given as 0·8 of the size of the charcoal iron wire rope; that is to say, if the iron be of 2in. circumference, the equivalent strength in steel would be thus found $2 \times {\cdot}8 = 1{\cdot}6$in. or 1⅝in. However, from experiments made by Mr. John, it would appear that the strength of the steel wire varies very considerably, aud, whilst the ratio in some cases with soft steel was less than that given, in other cases with hard steel, the ratio of strength was greater.

The breaking strain in tons of single rope, such as the lanyards, was found to be equal to the square of the circumference in inches, multiplied by the fraction.

The whole breaking strain in tons of the lanyards, rove in six parts, was found to be equal to the square of the circumference of a *single* part multiplied by the fraction ·843. The joint strength of the six parts is considerably less than six times the single part, and the disparity varied between 2·97 and 4·98; and it would appear that ill-made or defective dead eyes had a great deal to do with the apparent loss in strength.

The stretch of lanyards in six parts was found equal to the strain in tons multiplied by the distance from centre to centre of the dead eyes, and divided by six times the square of the circumference in inches of a single part of the lanyards.

The stretch of wire rope was found to be equal to the length of the shroud multiplied by the strain in tons, and divided by the square of the circumference and by 20.

Generally it is found that wire rope, when the strain is removed, does not "take up" all that it has been stretched and ultimately the stretching quality of the wire will be lost without much loss in strength. The stretching quality of wire rope to some extent depends upon the core being of hemp, and to reduce the stretch it has been suggested that the core should be of wire. Wire rope stretches more rapidly as the strain increases, whereas hemp rope stretches less rapidly; but these peculiarities are mainly observable as the ropes approach the breaking point.

This was written especially in relation to iron masts, but it is applicable to
wood masts and [illegible] although wood masts
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masts should have plenty of play. This curious fallacy has been maintained by still more curious arguments and theories; and we have known some sailing masters slack up the rigging to give it the required elasticity. It is obvious that the mast would have to supply the elasticity under such circumstances, as the strain would not come upon the rigging until the mast had been very considerably bent—perhaps almost to the breaking point. We need not dwell upon the bad effects of slack rigging* and a yielding mast further than to say, that anything which tends to render the application of the propelling force intermittent, or to absorb any portion of it and reduce its effect, must in some measure detrimentally influence the speed of a vessel; and if rigid rigging is necessary for the good performance of sailing ships, it is equally necessary for the attainment of the highest results in competitive yacht sailing.

Page 100, in the footnote, fifth paragraph from the bottom, *for* "multiplied by the fraction," read "multiplied by the fraction 0·2545."

TOPMAST RIGGING.

The topmast rigging will be cut (due allowance being made for the cross-trees), fitted, and served in the same manner as the main rigging, but the eyes at the lower end of the shrouds will be turned in round galvanised iron thimbles, to take the hooks of the setting-up tackles, or falls, as they are termed.

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* In selecting wire shrouds, pendants, or stays, be careful that flexible wire is not supplied; it stretches very badly, "takes up" again very little, and "constant setting-up and never taut" will be the inevitable result.

Each topmast backstay is usually in two parts, the lower part being the leg, which is in length equal to the housing length of the topmast. A thimble is eye-spliced into the upper and lower end of the leg, and a shackle joins it to the shroud.

Yachts above 10 tons usually have two topmast shrouds, or two backstays as they are more generally termed, on each side, and one "preventer" or shifting backstay each side. In yachts of 10 tons and under one backstay and one preventer each side are generally considered sufficient; in these vessels a thumb cleat is usually fitted to the cross-trees, and when the yacht is at anchor the preventer is put in this and set up with its tackle, for the sake of tidiness. In large yachts a cleat or score is also provided on the cross-trees, for the preventers when not in use. A favourite plan, however, is to set up both preventers from their eye bolts aft; and the only objection to this plan is, that there is more gear for the yards or jibbooms of passing craft to pick up if they come dangerously near; on the other hand, so far as appearance goes, it makes a yacht look a little more rigged.

Schooners, in addition to topmast shrouds and preventers, have a main-topmast stay which leads from the shoulder of the main-topmast to the foremast head (see Fig. 22); some cruising schooners further have a standing fore-topmast stay, which leads from the fore-topmast shoulder to the mainmast head.

The shifting or "preventer" backstays will be measured for length from the shoulder of topmast to taffrail, and then deduct from this length about six or seven feet for the setting-up tackle. In large vessels this tackle always consists of two double blocks, the standing part being generally made fast to the upper block, and then the fall leads from the upper block; but sometimes the tackle is put the other way up, so that the fall leads from the lower block. The advantage of this plan is that several hands can get on the fall for a "drag;" the other plan, however, is more shipshape, and if the fall be put under the cavel round a belaying pin, with a couple of hands to "swig" and one to take up the slack, the tackle will always be set up taut enough. The tackles are hooked to the trysail sheet bolts on the quarter. In some racing yachts a capital plan is adopted to avoid any possible mishap before the backstay can be properly set up: a tail block is seized to the lower end of the preventer just above the eye; a single rope is rove through this block, and one end of it made fast to the cavel aft; a knot is tied in the other end to prevent the rope unreeving. The rope is of sufficient length to admit of the preventer being carried into the main rigging without it being unrove. When shifting the backstays, as in gybing, one hand takes hold of the hauling part of this "whip" to leeward, and hauls the backstay aft and gets it set up fairly taut, whilst another hand prepares the tackle for hooking on as the boom settles over. If backstays are properly worked in this way, a topmast should never be lost in gybing.

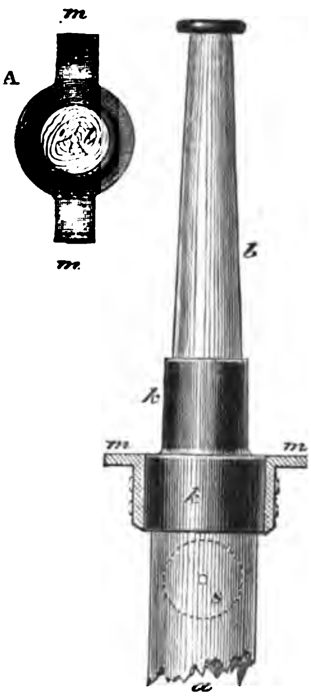

Fig. 27.

In all yachts it is a great advantage to be able to get the topmast quickly on deck, and in those of 40 tons and under the man-of-war plan of sending the rigging up on a funnel can be recommended. A topmast on deck, instead of up and down the mast, is as good as a reef; and in small yachts of 5 and 10 tons, where the stick can be easily "man-handled," the funnel arrangements can be made use of. Mr. Beavor Webb has adopted the plan in the Freda, and Mr. Baden-Powell in the Kohinoor, and both commend it. In the annexed diagram *a* is the topmast, and *b* the pole of the topmast; *s* topsail halyard sheave; *k* is the funnel; *m* and *m* are two catches riveted to the funnel; the catches rest on the cap of the mast in a fore-and-aft direction when the topmast is lowered, and prevent the funnel going down through with the topmast. The funnel, it will be seen, is made to fit on the shoulder of the topmast, the lower part of the funnel being greater in diameter than the upper part. Fig. A shows the funnel viewed from above, *o* being the shoulder, *b* the pole of topmast, and *m*, *m* the catches. All the topmast rigging, including preventers, also spinnaker and jib topsail halyard blocks, are fitted on the funnel over the shoulder. A stout rope grommet should be fitted on the shoulder of the cap as a bolster to prevent the rigging being cut. In lowering the topmast the halyards must be unrove from the sheave *s*; then, when the topmast is unfidded, it will come down; but the funnel, with the catches resting on the upper cap, will remain at the masthead—that is, the lower half of the funnel will be inside the cap, and the upper half above the cap. All the rigging, &c., of course remains on the funnel. To get the topmast up again, the pole will be shoved up through the funnel, and, when clear of the cap, the halyards will be rove through the sheave hole *s*. In lowering whilst racing, the flag would have to be taken off before bringing the pole through the funnel, as it might foul. So also if there are signal halyards, they must be unrove. Any good brazier would make the funnel, and rivet or weld the iron catches on. The funnel would, however, be better made of copper. Care should be taken that the lower part of the funnel is made as deep as the cap, and that it fits inside the cap easily, but not too loosely. The upper part of the funnel must be high enough to take all the rigging eyes and tails of blocks. The man-of-war funnels have no lower part, and the catches when the topmast is down have to be lashed to the cap; this of course takes up time. A topmast, with the funnel as described and as fitted by Mr. Webb in the Freda, can be got on deck in one minute, and be got up again in nearly as little time.

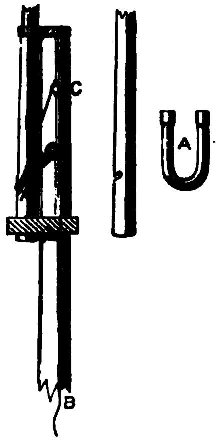

Fig. 28.

Various plans have been devised for fidding and unfidding topmasts from the deck, and the "tumbler" plan has been in fashion some time. In Fig. 28, A is a pawl which drops into a score in the topmast as the latter is got up. When the topmast has to be lowered, haul on the heel rope; and when the topmast is lifted sufficiently high, pull on the small rope B (which passes over the sheave C) until the pawl is clear of the score. The topmast can then be lowered.

The "self-fidding topmast" (Fig. 29) has been in use of late, and was designed and thus described by Mr. Augustine L. Dunphy:

"The fid consists of a properly-shaped bar of iron working rather stiffly on a pin in the heel of the topmast, the slot (see A, 1) in which is cut specially to suit the peculiar action of the fid; a stout bolt, B (2), firmly screwed into the masthead, completes the whole of the mechanical part of the arrangement.

"*To Fid the Topmast.*—The fid is placed in position, as shown at A (2), by hand whilst the topmast is down, and then, hauling on the heel rope, the topmast rises until the projecting part (A) of the fid strikes the bolt B (a score is cut in the cap, so as to enable the fid to clear), and is pushed into a horizontal position when the heel rope is slacked, and the topmast will fall a few inches, fidded as securely as by the old-fashioned bolt (see 4, Fig. 29).

"*To Unfid.*—Haul on the heel rope until the topmast is chock up; the fid rising with topmast again strikes the bolt B, thereby changing its position to that shown in (3); ease up the heel rope, and the topmast is free to come down.

"A little extra care is necessary in sending up the topmast, as if driven up too high the fid is fidded and unfidded, when a hand must go aloft to right, or the topmast lowered so as to place the fid in position again. This fid has been in almost constant use, and has never failed me in any case. It will act equally well when the mast is at any angle, and dispenses with the tripping lines, which are always getting foul or being carried away. It never fails to bring down the topmast."

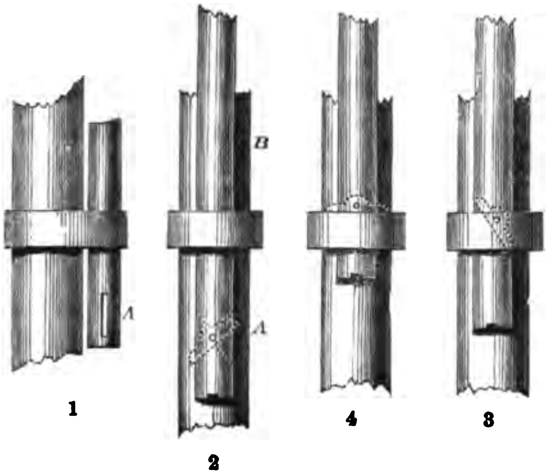

FIG. 29.

THE MASTHEAD PENDANTS AND RUNNERS.

The pendants are made of wire rope, and are put over the masthead before the shrouds, and are covered with canvas. The pendant is usually in length two-thirds the distance deck to hounds. The lower end of the pendant is shod, or, if not shod, an eye is turned in. A single block is shackled to this end of the pendant, and through the block the runner is rove. The runner is sometimes made of rope, but in large racing vessels more frequently of flexible wire rope. The runner in length is generally three-fifths the distance deck to hounds. Each end of the runner has a thimble-eye splice, with a strong hook at the end of the standing part. This part leads aft to be hooked to an eye bolt on the rail. The tackle is shackled to the other part, and usually consists of a fiddle block and single block below, but sometimes the upper block is a common "double." The fall always leads from the upper block. In some cruising yachts the standing part is shackled to the eye bolt in the rail, but the general practice in racing vessels is to have a hook, as the runner has so frequently to be let go to let the boom off. With the wind much forward of the beam, very little strain comes on the runner; but they should be kept well set up, or otherwise the mast may go forward, and bring about a slack forestay, and throw an undue strain on the aftermost shrouds.

FORESTAY.

The forestay goes on "over all;" but now the practice is to have the eye, or collar, large enough to go well up the masthead, above the yoke and over the throat-halyard-block bolt. The collar encircles topmast as well as the yoke; and the eye should be made in so that the splice comes just under the crosstrees. The yoke will then give the spread to the collar necessary to allow the topmast to go up and down without touching it. The collar should be leathered. The stay leads down to the fore side of the stemhead, where it is rove through a hole. The end is then made into a bight (with a thimble in it), well seized (sometimes a bullseye is spliced in), and set up with a lanyard to the bitts. In reeving the forestay through the stemhead it must not be forgotten that the iron hanks or rings for the foresail must go on it first.*

TRIATIC STAY.

Formerly, in schooners, a mainstay led from the mainmast head to the deck, forward towards the foremast, and was set up by a tackle, one on either side; in tacking or wearing, the lee one had to be eased up, and, if smartness were not displayed the mainmast would fall aft, as the stay had to fulfil the same duty for the mainmast that the forestay does for the foremast. This plan was found very inconvenient in racing schooners, and, about twenty years ago, the fashion became general to carry a stay, termed a triatic, to the foremast head, a larger forestay being introduced to bear the extra strain thrown upon it. The disadvantage of this plan is that it entails some trouble in tacking or gybing, as double fore-topsail sheets and tacks are required. The fore topsail has to be clewed up every time the schooner is put on a different tack, and the sail re-tacked and re-sheeted to leeward of the stay. To obviate this trouble, double triatics, or jumpers, have been tried, the lee one being always eased up; but there was still the difficulty of getting the clew over the main-topmast stay, and the danger of not getting the lee triatic (now the weather one) set up before the vessel filled. On the whole, the single standing triatic gives the least trouble and is the safest, but, of course, one will sometimes give way. If such an accident occurs, it is usual to take one of the main runners forward, and set up..

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* In schooners, when the bowsprit goes out over the stem, the forestay is set up to the span-shackle by a screw bolt and nut.

TOPPING LIFTS.

In vessels under 20 tons there is one topping lift a side, and the standing part is hooked to an eye in an iron band round the boom. The topping lift is rove through a single block shackled to an eye on the cheeks of the mast. The hauling part of the topping lift has an eye, to which the purchase block is hooked or shackled; the purchase consists of a double and single block.

In vessels from 20 to 50 tons the topping lift is single, with the addition of a runner, the standing part of which is fast to the rail, or to the cavel abreast of the mast.

In vessels above 50 tons it is usual to have double topping lifts, with runner and tackle; in such case the standing part of the lift is shackled to the block at the masthead, and leads thence through the block on the boom, and back through the block at the masthead.

Some large vessels have a single topping lift a side, made of flexible wire and covered with canvas. These, of course, have the runner and tackle. These topping lifts look neater than the double (rope) ones, and, so far as we know, overhaul themselves just as readily.

Very small craft have only one single topping lift, and of course, when under way, this one is always slack if to leeward, whereas the practice in larger craft is always to have the weather lift hand taut.

BOWSPRIT SHROUDS.

Bowsprit shrouds are now invariably made of wire rope, and have a thimble eye-splice in each end; one end is shackled to the iron at the bowsprit end, the other to the setting-up tackle. This tackle formerly was always outboard, hooked to an eye-bolt on the top strake, where it not only dragged through the water and picked up weeds, but was not so readily got at when reefing the bowsprit. The tackle consists of an iron fiddle block and a single block, the latter being at the after end of the tackle. An eye bolt is fitted in the deck to take the tackle. This bolt should go through a beam, and have a plate and spur on deck; the strake of deck plank where the bolt is should be of hard wood, and the bolt should be a very strong one. Several vessels have lost their bowsprits through this bolt drawing, crushing through the plank, or breaking off short. Notable instances were afforded of this in the match for the Queen's Cup at Cowes in 1874, when the Morna schooner and Kriemhilda cutter lost their bowsprits from this cause.

Oddly enough, the Kriemhilda lost her bowsprit at Torquay the year before from the same cause, and so did Iona, and numberless other cases have occurred. Hatcher fits a band, with an eye in it, round one of the stanchions, and has never heard of one giving out. Another fruitful cause of mishap to bowsprits has been the practice of having an iron shoe instead of a thimble eyesplice for the shackle. Even when the shoe is a long one, it will occasionally strip in consequence of the wire parting where the rivets go through, and a shoe should never be trusted for any part of the wire standing rigging.

BOBSTAY.

Various ingenious plans have been invented for bobstays, as no part of a yacht's gear so frequently gives out; but the most usual plan of making up a bobstay is as follows: a copper bar shackled to the stem, and about as long as the bowsprit is high out of the water; then a wire pendant and tackle. The tackle has a single block next the pendant, and a double one at the bowsprit end, the fall leading inboard at the stem. The cordage selected for the tackle is usually bolt rope. A common practice in racing vessels is to have a "baby bobstay," or preventer which is not set up quite so taut as the other; this preventer has no doubt saved some bowsprits, but, on the other hand, it has undoubtedly been the cause of many being carried away. Constantly setting up the jib, or the strain of the jib alone, or the strain of the bowsprit when set down to a crook, will soon cause the fall to stretch or "come up," and then an equal strain comes on both. But very frequently the preventer is set up a little tauter than the other; in such cases, if there be any weight in the wind, the preventer is almost certain to part, and the other, if the jerk be very great, may go with it. If the main bobstay should go first, it would be hardly reasonable to expect the other and weaker one to stand; it may, it is true, just save the bowsprit, but the sailing master will have so little confidence in the preventer that he will order the jib sheets to be eased up, and will gill his vessel along, whilst the other bobstay is being patched up, if such a thing as patching be practicable. Another danger attending the practice of having two bobstays is that the main one is never quite so stout and strong as it otherwise would be; and, as it is almost certain that an unequal strain will come upon them, one only has practically always to do the work. Therefore by far the wiser plan is to have one stout and strong bobstay, equal in fact to the united strength of the two.

RUNNING RIGGING.

Jib Tack, Jib Halyards, and Jib Sheets.

The jib tack requires to be of great strength, and is made indifferently, according to the judgment of the person who has the fitting out of the yacht, of rope, chain, or flexible wire rope. Rope does very well in vessels under 40 tons, but wire is to be preferred, and it is found to stand better than chain. The jib tack leads from the traveller down through a sheave hole at the bowsprit end (inside the rigging iron) a block is shackled to the end of the tack through which the outhaul is rove. The standing part of the outhaul fall is put over one of the bitts with a running eye; the hauling part leads on board by the side of the bowsprit. A single rope inhaul is generally fast to the traveller.

Jib halyards are, as a rule, made of chain, as it runs better, and the fall stows in a smaller compass when the jib is set; in fact, the fall is generally run through one of the chain pipes into the forecastle, where it helps a trifle as ballast. However, several large vessels, such as Livonia, Modwena, and Arrow, have had Manilla rope. The jib halyards are rove through an iron (single) block (which is hooked or shackled to the head cringle of the jib), and then each part leads through an iron (single) block on either side of the mast head (see Fig. 25). The hauling part usually leads down the port side of the mast; the purchase is shackled to the part that leads through the block on the starboard side. In vessels above 40 tons a flexible wire runner is invariably used in addition to the purchase; one end of the runner fast on deck, and the other, after leading through a block on the end of the jib halyard, is shackled to the upper block of the purchase. The purchase consists of a double and single block, or two double; in the former case the single block is below, with the standing part of the tackle fast to it; but where two blocks are used, the standing part of the tackle is made fast to the upper block. As a great deal of "beef" is required to properly set up a jib, it is usual to have a lead of some kind for the "fall"* of the purchase on deck, such as a snatch block. It is, of course, necessary to have a "straight" luff to a jib, but very frequently the purchase is used a little too freely; the result is that a link gives way in the halyards, the luff rope of the jib is stranded (generally near the head or tack, where it has been opened for the splice), and sometimes the bobstay-fall is burst; we once saw the latter mishap occur on board the Oimara during a match at Southsea. These mishaps can be generally averted by "easing" the vessel whilst the jib is being set up, or choosing the time whilst she is in stays or before the wind.

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* The "fall" of a tackle is the part that is taken hold of to haul upon.

Jib sheets in vessels under 30 tons are usually single, but in vessels larger than 30 tons they are generally double.

FORE HALYARDS, FORE TACKS, AND FORE SHEETS.

The fore halyards are usually fitted as follows: The standing part is hooked or shackled to an eye bolt under the yoke on the port side, then through a single block on the head of the sail, and up through another single block hung to an eye bolt under the yoke on the starboard side. No purchase is necessary, as the sail is set on a stay; but in yachts above 10 tons the tack leads through the stem head and is bowsed down by a tackle. The tackle consists of a single and double block, or two doubles according to the size of the yacht. In yachts of 40 tons and upwards the tack is usually made of flexible wire rope. Fore sheets in yachts under 15 tons are usually made up of two single blocks. The standing part is made fast to the upper block (hooked and moused or shackled to the clew of the sail). In larger vessels a double, or single, or two double blocks are used, the hauling part or fall always leading from the upper block. In very large vessels, such as 100-ton cutters or yawls, or 140-ton schooners, "runners" are used in addition to the tackles. These are called the standing parts of the sheets: one end is hooked on the tackle by an eye, passes through a bull's-eye of lignum vitæ on the clew of the sail, and is then belayed to a cavel. The sail is then sheeted home with the tackle.

MAIN AND PEAK HALYARDS, MAIN TACK, MAIN SHEET, AND MAIN OUTHAUL.

The main or throat halyards are generally rove through a treble block at the masthead, and a double block on the jaws of the gaff. The hauling part of the main halyards leads down the starboard side of the mast, and is belayed to the mast bitts. The main purchase is fast to the standing part, and usually consists of a couple of double blocks, and the lower one is generally hooked to an eye bolt on the port side. In vessels under 15 tons it is unusual to have a main purchase, and when there is no purchase the upper main halyard block is a double one, and the lower a single. However, many racing 10-tonners have a main purchase, and Mr. Beavor Webb rigged the 5-tonner Freda with one. The principal object in having a main purchase in a small craft is that the mainsail can be set better, as in starting with "all canvas down" the last two or three pulls become very heavy, especially if the hands on the peak have been a little too quick; and a much tauter luff can be got by the purchase than by the main tack tackle. Of course the latter is dispensed with in small vessels where the purchase is used, and the tack made fast by a lacing round the goose-neck of the boom. By doing away with the tack tackle at least 6in. greater length of luff can be had in a 5-tonner, and this may be of some advantage. The sail cannot be triced up, of course, without casting off the main tack lashing; but some yacht sailers consider this an advantage, as no doubt sailing a vessel in a strong wind with the main tack triced up very badly stretches the sail, and looks very ugly.

The peak halyards in almost all vessels under 140 tons are rove through two single blocks on the gaff and three on the masthead, as shown in Plate I. and Fig. 25. Some vessels above 140 tons have three blocks on the gaff, and in such cases the middle block on the masthead is usually a double one. The standing part of the peak halyards to which the purchase is fast leads through the upper block and down on the starboard side.

A common practice in racing vessels now is to have a wire leather-covered span (copper wire is best) with bull's-eye for each block on the gaff to work upon, and this plan no doubt causes a more equal distribution of the strain on the gaff.

The main tack generally is a gun tackle purchase, but in vessels above 60 tons a double and single or two double blocks are used. In addition, some large cutters have a runner rove through the tack cringle, one end being fast to the goose-neck of the boom, and the other to the tackle. In laced mainsails the tack is lashed to the goose-neck.

The main sheet should be made of left-handed slack-laid Manilla rope. The blocks required are a three-fold on the boom, a two-fold on the buffer or horse, as the case may be, and a single block on each quarter for the lead. Yachts of less than 15 tons have a double block on the boom, and single on the buffer.

Most American yachts have a horse in length about one-third the width of the counter for the mainsheet block to travel on. For small vessels, at any rate, this plan is a good one, as the boom can be kept down so much better on a wind, as less sheet will be out than there would be without the horse. A stout ring of indiarubber should be on either end of the horse, to relieve the shock as the boom goes over.

The mainsail outhaul is made up of a horse on the boom, a shackle as traveller, a wire or chain runner (attached to the shackle, and rove through a sheave hole at the boom end), and a tackle. In small vessels the latter consists of one block only; in large vessels of two single, or a double and single, or two double blocks. The old-fashioned plan of outhaul, and one still very much in use, consists of an iron traveller (a large leather-covered ring) on the boom end, a chain or rope through a sheave hole and a tackle. This latter plan is perhaps the stronger of the two; but an objection to it is that the traveller very frequently gets jammed, and the reef cleats have to be farther forward than desirable, to allow the traveller to work. Sometimes, instead of a sheave hole, the sheave for the outhaul is fitted right at the extreme end of the boom, on to which a cap is fitted for the purpose.

TOPSAIL HALYARDS, SHEETS, AND TACKS.

The topsail halyards in vessels under 10 tons consist of a single rope rove through a sheave hole under the eyes of the topmast rigging.

Yachts of 10 tons and over have a block which hooks to a strop or sling on the yard, or, if the topsail be a jib-headed one, to the head cringle. The standing part of the halyard has an eye, which is put over the topmast, and rests on the eyes of the rigging; the halyard is rove through the block (which is to be hooked to the yard), and through the sheave hole at the topmast head. It is best to have a couple of thumb cleats on the yard where it has to be slung; there is then no danger of the strop slipping, or of the yard being wrongly slung.

When the topsail yard is of great length, an upper halyard is provided (called also sometimes a tripping line or trip halyards, because the rope is of use in tripping the yard in hoisting or lowering). This is simply a single rope bent to the upper part of the yard, and rove through a sheave hole in the pole, above the eyes of the topmast rigging. The upper halyards are mainly useful in hoisting and for lowering to get the yard peaked for going up; however, in very long yards, if bent sufficiently near the upper end, they may in a small degree help to keep the peak of the sail from sagging to leeward, or prevent the yard bending.

The topsail sheet is always a single* Manilla rope. It leads through a cheek block on the gaff end, then through a block shackled to an eye-bolt under the jaws of the gaff. In most racing vessels nowadays a pendant is used for this block, as shown in the diagram (Plate 1). The pendant should go over the mast with a running eye. By this arrangement the strain is taking off the jaws of the gaff and consequently off the main halyards. The hauling part of the rope is generally put round one of the winches on the mast to "sheet" the topsail. The topsail tack is generally a strong piece of Manilla with a thimble spliced in it, to which the tack tackle is hooked.

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* The Oimara, cutter, had double topsail sheets rove in this way: one end of the sheet was made fast to the gaff end; the other end of the sheet was rove through a single block on the clew of the sail; then through the cheek block at the end of gaff, through a block at the jaws of the gaff, and round the winch.

Jib-topsail halyards and main-topmast-staysail halyards are usually single ropes, rove through a tail block on topmast head; but one or two large vessels have a lower block, with a spring hook, which is hooked to the head of the sail. In such cases, the standing part of the halyards is fitted on the topmast head with a running eye or bight.

SPINNAKER HALYARDS, OUTHAUL, &c.

Spinnaker halyards are invariably single, rove through a tail block at the topmast head.

The spinnaker boom is usually fitted with a movable goose-neck at its inner end. The goose-neck is generally put into its socket on the mast, and then the boom end is brought to the shank. At the outer end are a couple of good-sized thumb cleats, between which the after and fore guy are put, there being a running eye in each. The fore guy is a single rope; the after guy is a pendant with a block at the end, through which a rope is rove. The standing part of this rope is made fast to a cavel-pin, or cleat on the quarter, and so is the hauling part when belayed. The after guy thus forms a single whip-purchase (see Plate I.). The outhaul is rove through a sheave hole at the outer end of the spinnaker boom. The topping lift consists of two single, a double and single, or two double blocks, according to the size of the yacht.

Formerly a bobstay was used; but, if the boom is not allowed to lift, it will bend like a bow, in fact, the bobstay was found to be a fruitful cause of a boom breaking, if there was any wind at all, and so bobstays were discarded. The danger of a boom breaking through its buckling up can be greatly lessened by having one hand to attend to the topping lift; as the boom bends haul on the lift, and the bend will practically be "lifted" out.

Small yachts seldom have a fore guy to spinnaker boom, but bend a rope to the tack of the sail (just as the outhaul is bent) leading to the bowsprit end; this rope serves as a fore guy, or brace, to haul the boom forward; and when the spinnaker requires to be shifted to the bowsprit, the out haul is slackened up and the tack hauled out to bowsprit end. In short, double tacks are bent to the spinnaker tack cringle, and one rove through the sheave hole or block at the spinnaker boom end, and the other through a block at bowsprit end. But generally the large spinnaker (set as such) has too much hoist for the jib spinnaker, and a shift has to be made; even in such case no fore guy is used in small vessels, but one hand slackens up the topping lift a little, and another the after guy, and if there be any wind at all, the boom will readily go forward. Sometimes, instead of a sheave in the boom, a tail block is used for the outhaul. Mr.

Beavor Webb adopted this plan in the Freda, as he found it difficult to get a fair lead with the sheave. A hole is made in the boom end, through which the tail of the block is passed and secured, In a five-tonner the after guy is a single rope without purchase, and the topping lift is also a single rope, rove through a block under the lower cap.

As spinnaker booms are now carried so very long, they will not go under the fore stay; consequently, when the spinnaker has to be shifted, the boom must be unshipped. To shift the boom, the usual practice is to top it up, lift it out of the goose-neck, and then lower the end down the fore hatch or over the side of the vessel until the other end will clear the forestay.

When spinnakers were first introduced no goose-neck was used, the heel of the boom being lashed against the mast. A practice then sometimes was to have a sheave hole at either end of the boom, with a rope three times the length of the boom rove through each sheave hole. One end of this rope served as the outhaul, the other for the lashing round the mast. To shift over, the boom was launched across to the other rail, and what had been the inboard end became the outboard end. Of course the guys had to be shifted from one end to the other. As spinnaker booms are now of such enormous length, it would be almost impossible, and highly dangerous, to work them in this way, although it might do for a five-tonner.

Spinnaker booms when first fitted with the gooseneck were no longer than the length from deck to hounds, so that they could be worked under the forestay without being unshipped. However, it would appear that the advantages of a longer boom are greater than the inconvenience of having to unship it for shifting, and now, generally, a spinnaker boom when shifted and topped up and down the mast, reaches above the upper cap.

The following plan was recommended in the *Field* by a correspondent under the initials of "S. J. H." It was worked during the summer of 1876 in the Lily 10-tonner, but we never met with it elsewhere, although the plan seems as good as any such contrivance could well be. "S. J. H." thus described the arrangement.

"Having had some experience in yacht racing, my attention has often been drawn to the inconvenience experienced in shifting the spinnaker boom from one side to the other, as, if not sufficiently short to clear the collar of the forestay, it necessitates unshipping the spar from the gooseneck, and either lowering the end into the forecastle, or else getting it over the side. The former method is no doubt the safest, but it limits the length of the boom to the distance from collar of forestay to deck *plus* depth of forecastle. By the latter plan any length can be obtained, but its danger and inconvenience are too great to warrant its continuance. Any plan that will give an almost unlimited length of boom, and at the same time be convenient to shift, ought to please yacht owners, and above all those most interested, viz., the racing captains and paid hands. The plan I would suggest is simple, and whilst offering many advantages, only adds one more spar, rope, and block to a yacht's gear. Take a yacht of say 65 tons, and suppose her 70ft. long for tonnage and 15ft. beam, with a mast measuring 60ft. from deck to cap, from which if 9ft. is subtracted for mast-head, and 4ft. more allowed for the angle made by the forestay, a spinnaker boom, to swing over clear, cannot exceed 43ft. (as the gooseneck is 3ft. from deck), which of course is much too little to balance the mainboom and sail. What I propose is to have a boom of 42ft., and another smaller one of 21ft. made a little heavier than the long one, and fitted with two irons 7ft. apart; the longer one to be made in the usual manner, with bolts in both ends, for the gooseneck; but the sheaves in the ends to be, one vertical, and the other horizontal. It will then make a very snug storm boom for the balloon jib when shipped singly, whilst the smaller one, by leading a tack rope (or outhaul) through the block on the outer iron will do very well for the staysail. In the drawing, in case No. 1, the boom is on

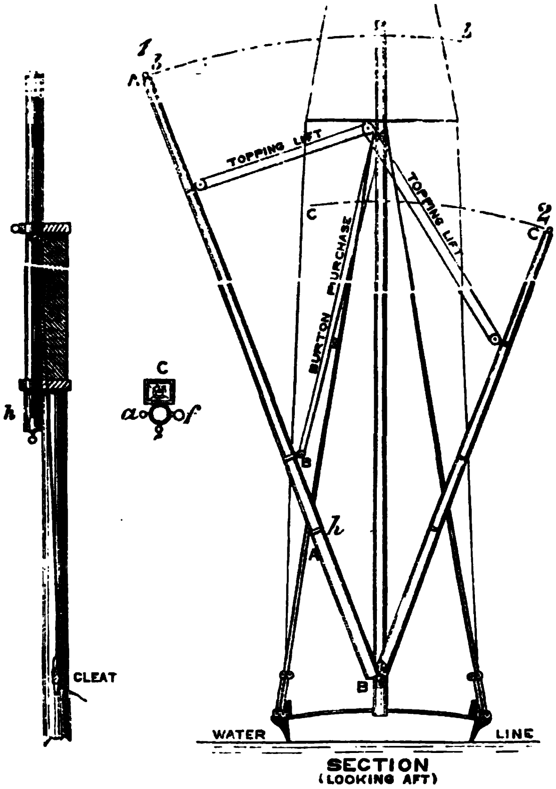


Fig. 30.

end and ready for letting fall to starboard; and in No. 2 dipped and falling to port. A A (No. 1) represents the 42ft. boom, and B B the 21-footer; the dotted line *b b* the arc the boom would travel if not let run down; and the dotted line c c the actual line it travels when housed. C in the small diagram represents the outer iron or cap on the end of the small boom (which can be made square or round; in the diagram I have made it square, to prevent twisting), and *a* a bolt to which the standing part of the heel rope is made fast by clip hooks; the rope passes through the horizontal sheave at *h*, and back to the block on the cap at *f*. The fall can be belayed to a cleat on the small boom, or would greatly ease the strain on the gooseneck if made fast on the rail or to the rigging. When gybing it would only be necessary to top the boom by the lift, let go the heel rope, and let it run down; then swing over, lower away, and haul out the boom when squared. It would be better to hook on the Burton purchase to the cap at *e*, both as an extra support and to make sure of the boom whilst swinging. This plan would not only obviate the danger and trouble of dipping the boom, but give a 57ft. spar, besides giving greater strength, the boom being double where the most strain comes; and the extra weight is a positive advantage, as helping to balance the main boom. Of course this plan would allow of almost any length of spars, as a 40ft. lower boom would give a 74ft. spar, and still leave 8ft. between the irons; and in these days of excessive spars and canvas no doubt it would be attempted to balance a ringtail, but the lengths given seem a good comparative length for any class."

CHAPTER XIII.

CENTRE-BOARD BOATS.

Although it may be difficult to say what is a boat and what is a yacht, when we are speaking of small craft, yet we think a great deal of this difficulty will be removed if we define a boat to mean a vessel that is not wholly decked, and that can be rowed. In selecting one of these craft that is either open or partly open, the main guide, of course, will be the locality. Thus, if the boat is for Brighton, one of the shallow centre-board beach boats used thereat will be the most suitable, inasmuch as they can be readily "beached" or hauled out of water; it being necessary that they should be so hauled up, as there is no sheltered or safe anchorage at Brighton. For the Thames above bridge, where the winds are light and baffling, a very light centre-board gig is the most useful, as it sails well in light winds, and is easily rowed in calms. On the Mersey, where the boats can lie afloat, and where generally there is more wind and sea than any ordinary boat could well tackle, a heavier and deep keel sailing boat is in use. At the same time, a keel boat quite as light as the Surbiton boats has been introduced on the Mersey; but, in order that they may safely encounter the rough water, are nearly wholly decked in. On the south coast all sorts of sailing boats are to be met with, from the old-fashioned skiff and wherry to very many versions of the Itchen boat.

The centre-board, it appears, was invented, or rather adapted, from the lee-board by Captain Schank, of the British Navy, somewhere about 1774. We have not come across any contemporary record of the invention, but in Charnock's "History of Marine Architecture," published in 1802, the fact is alluded to, together with a description of a boat with a sliding keel built by Capt. Schank at Boston, Massachusetts, in 1774, for Earl Percy (afterwards Duke of Northumberland). The engraving Fig. 31, on the next page, represents this boat, and, so far as we know, is the oldest authentic record of the sliding keel. At about the same time Capt. Schank, was very strongly urging the English government to cease building deep ships, and to build shallow ones, fitted with one or more sliding keels. The Admiralty were not, however, to be persuaded into such a startling revolution in Naval Architecture; still they so far humoured Capt. Schank, that in 1789 a boat was built and fitted at Deptford Dockyard, according to the plan shown in the accompanying engraving Fig. 32. The use of the three boards was as follows: In tacking, or laying to, the centre board and after board were raised; in wearing the centre-board and fore-board were raised; also in scudding the centre-board and fore-board were raised; going over shallows the three boards were raised. On a wind the three boards were lowered, each to such depth as seemed best to balance the sails. The report of the trials made with this boat seem to have very favourably impressed the Admiralty, and Capt. Schank was intrusted to design a cutter of 60ft. length and 20ft. beam, with three sliding keels. She had a midship section something like a barge, and a draught of water of 6ft. 6in., and was named the "Trial." She was reported to be a good sea boat, and very handy; but another vessel with centre-boards called the Lady Nelson was less favourably reported upon, and the Admiralty, we believe, built no more centre-board ships, and, so far as we were concerned, the invention was lost sight of until the visit of the America in 1851 drew attention to them. Not that the America had a centre-board, but other American

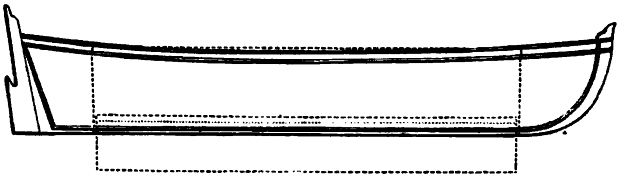


FIG. 31.

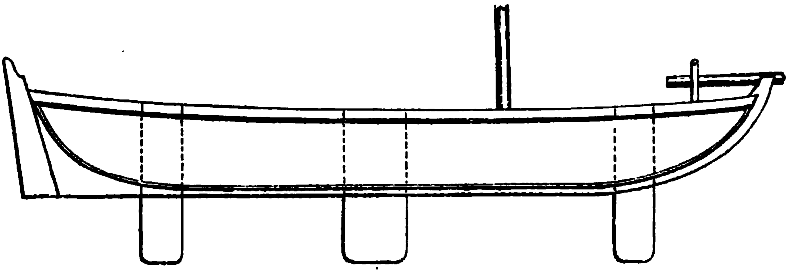


FIG. 32.

yachts had, and Englishmen about this time became very curious about Transatlantic naval architecture.

The centre-board was still a contrivance something like Earl Percy's, but, instead of being dropped equally fore and aft, was pivoted at the fore end, as shown in the accompanying sketch (Fig. 33) according to a plan introduced by Capt. Shuldham, of the British Navy.

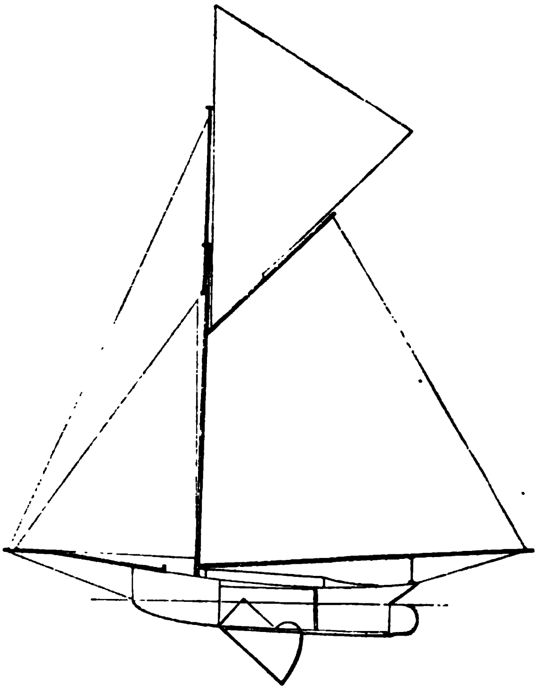


Fig. 33.

The small centre-board American sloop Truant was brought over here in 1853, and, although only 20ft. on the water line and 1ft. 2in. draught, beat all the crack 7-tonners in the Prince of Wales' Yacht Club a quarter of an hour in a thrash from Blackwall to Northfleet in a nice breeze, and was very roundly abused for her success. All sorts of stories were current about her shifting ballast, and her crew having their pockets filled with lead shot! After this success Truant went to the Mersey and Lake Windermere, but what ultimately became of her we do not know. Her rig was as shewn in the drawing over leaf (Fig. 34), and is the same as the fashionable sloop of the present day, excepting that the foresail or jib is laced to a foot yard, and tacked at about one-fifth its length from the outer end of the yard on a bumpkin.

The Una was the next importation from America, and, although generally resembling the Truant in hull, differed in sail plan, as the mast was stepped farther forward, and she had no headsail whatever.

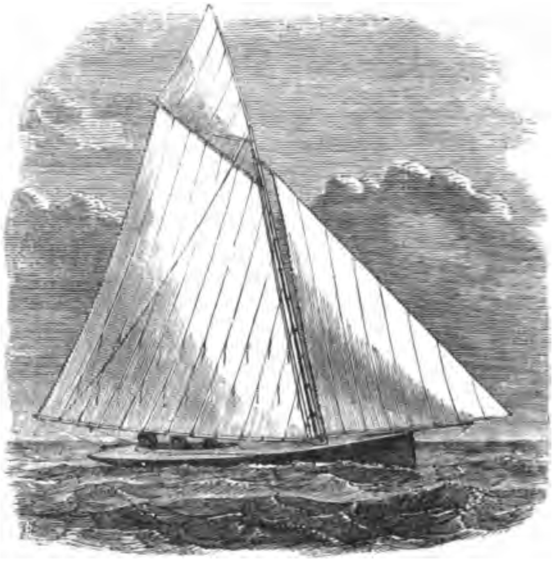


FIG. 34.

The double centre-board was much advocated in America in 1871, but we believe that no large yacht was built on the plan. However, in 1876 the idea occurred to Mr. W. Jeans, of Christchurch, to have a small craft provided with two boards, and he published the following description of the boat and drawing (see Figs. 35 and 36):

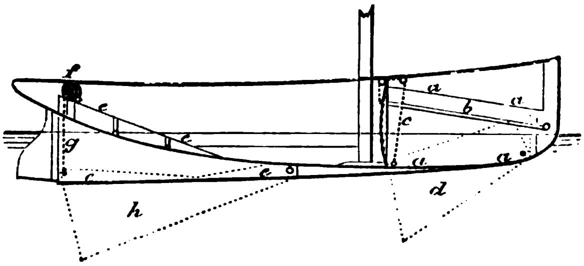


FIG. 35.

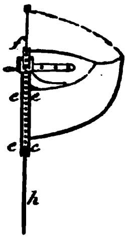
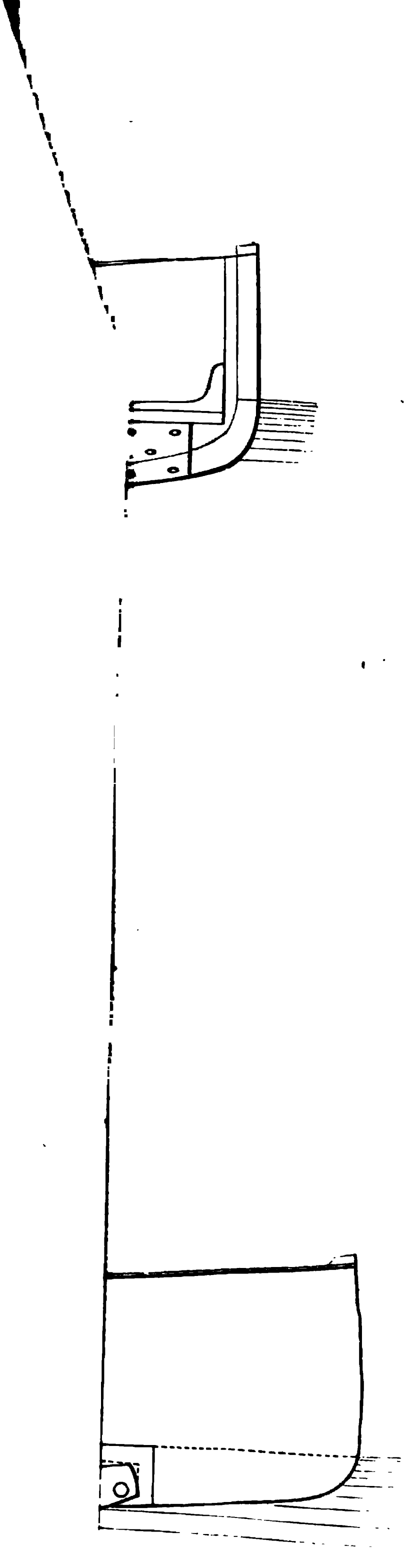


FIG. 36.

The letters *a a a a*, show the fore trunk; *b*, lever; *c*, chain; *d*, keel; *e*, aft trunk; *f*, wheel; *s*, chain; *h*, aft keel.

Mr. Jeans thus referred to his boat:—

"I found her answer remarkably well, both for speed, handiness, and weatherly qualities. The keels, which are of iron, are situated



fore and aft. The fore keel, having its trunk in the cuddy, takes up no room in the boat, and is lifted by a lever and chain band, which runs over a couple of sheaves on the deck beam to get a straight pull. Holes are bored about an inch and a half apart in the support of the after end of the trunk to take a pin, which regulates the depth of keel. The trunk of the aft keel is the dead wood in the run of the boat. The keel is lifted into its trunk by a small wheel and winch, the wheel being large enough to take up the chain in one turn without overlapping, a dog catching it at any required depth.

"The advantages are these. The keels take up no room in the body of the boat; they can be regulated to carry any kind of helm. By lifting up the fore keel in wearing the boat is much sooner round. If there is a doubt of her not coming about in a seaway, wind up the aft keel, when she will immediately shoot into the wind, dropping it again as soon as she fills on the other tack. In beating to windward in a seaway she will fetch where she points, unlike the ordinary centre-boarder, which, having no grip forward, is knocked to leeward with every sea. She is 12ft. long on the keel, and 6ft. beam, and though of such extraordinary proportions, is remarkably fast, which, I am convinced, partly arises from the proper depths which can be given to the keels, whereby the rudder (except for altering her course) is never out of the line of the keel, consequently never helping to stop her way."

No doubt the two boards may be found useful under exceptional circumstances, but the single centre-board, as generally in use, is much to be preferred. Such a boat will be more sensitive to slight alterations of her helm, and generally will be more agreeable to sail on a wind. The strongest reason for having two boards would be in the case of a shallow vessel that had to keep the sea, and might have to scud in very disturbed water and generally to encounter heavy weather. However, a yacht of the deep type, with strong fixed keel, would be better adapted for such work.

Two other plans for centre-boards were proposed, in 1877, by Lieut. Tipping, R.N. and Mr. A. J. Lane. The two plans are almost identical, as will be seen by a reference to Fig. 1, Plate II.

Lieut. Tipping, in describing his invention, says: "One of the chief objections to the ordinary centre-board keel is, that the case takes up so much room in the cabin, dividing it completely in half; if the keel be a large one, it comes up to the cabin ceiling when hauled up. To obviate this disadvantage, I propose a plan of extending the deep keel throughout the whole length of the vessel, as shown in the drawing in above plan, lowering the case considerably, if necessary keeping it under the floor altogether, and getting the same area by length instead of depth. The only disadvantage of extended length that I know of would be that the staying power would be diminished a little; but, on the other hand, a vessel would stay well with the proposed keel in shallow water, where she would not do so with only a third of the board down if it were on the short system.

"The case extends from stem to stern post, its planks being countersunk into each, and all riveted together, the heads of which are shown in the drawing. The keel proper is on top of the case, into which the keel is countersunk, and all riveted together. A section of it is shown at *a* in the transverse section, Fig. 2, Plate II. It is securely kneed to stem and sternpost. The case is divided into two compartments by a triangular piece of wood, shown in the centre of sheer plan, shaded. Rivets go through this and both sides of the case, to prevent its closing or opening by warping or straining. The floors are of iron, flat, and bent upon its edge, to fit over the top of keel down side of case, and bolted to timbers acting as clamps to prevent any spring in the case. One is shown in Fig. 2, marked *b*. In the drawing the keel and floors come above the flooring, as the boat's floor is flat, and area of drop keel large; but this of course is not necessary in a slightly deeper build.

"The drop keel is in two pieces; they are hinged together in the centre at *f*; the foremost one pivots in the fore part of the case outside the rabbet, as shown in Fig. 1, Plate II. at *c*. The after keel has a slot cut in it, in which the bolt *d* works as the keel is raised or lowered. They are raised either by a screw working through a stuffing box on top of the keel proper, or by a rope and tackle, as in the ordiuary way, the rope working through a pipe or trunk built up above water, as *e*; a wormed wheel would be the most complete, working on the spindle after coming through the stuffing box, but it must be free to rise up in case of striking the ground. On the keel being raised, the upper corners above the hinge will commence to separate, and pass on each side of the triangular piece of wood before spoken of; until they arrive at the top of case, as shown by the dotted lines in Fig. 1, Plate II., which position they will occupy inside the case, the foremost one pivoting on *c*, and the after one receding aft through the length of the slot spoken of.

"An improvement to the slot and bolt might be to hang the aft end by a rope with tackle, and to have the power of dropping it a little at its after end, to counteract weather helm if necessary. I imagine that this system of building would be much stronger than the ordinary plan of splitting the keel for one-third of the length; and I see no reason why it should not be applied to large yachts, enabling them to reduce their draught of water by a couple of feet at all events; and if the keels were made of iron it would keep the weights low."

Mr. Arthur James Lane, of Surbiton, invented a similar contrivance (Fig. 3, Plate II.). Mr. Lane proposes that his board should be made of boiler-plate. The fore end of the fore half of the board is pivoted as shown; at A B the plate is doubled, so as to form a case to receive the fore end of the after-plate. This after-plate works on what might be termed an eccentric pivot, as shown at E. The two plates are pivoted together at D, the after-plate being shut in the fore one as already described. The plates are lifted by a rope or chain (attached to the after-plate), and a barrel as at K. The plates when housed have their centre pivot at H, and the after end of the stern-plate goes into the position shown at F.

So far as we can judge, there is not much to choose between the two plans; but, on the face of it, that of Lieut. Tipping's looks the best for work, as more of the board is housed at the ends. However, the other plan has, by virtue of the "hump" (which could be increased) a better hold amidships.

It should be noted that Lieut. Tipping's plan, as shown, is applied to a moderately deep yacht, so that the plates are housed under the platform. Mr. Lane's plan, as shown, is applied to a 17ft. shallow centre-board gig, for rowing or sailing.

It is usual to give a boat of about 17ft. in length six or seven square feet area of centre-board; but in Mr. Lane's plan as much as nine square feet are shown. The area of the immersed longitudinal vertical section of the boat is ten square feet, and the centre of gravity (centre of lateral resistance) is in the same vertical line in each, that is 9ft. abaft the fore side of the stem at the load water-line. The weight of the plates, if of iron ¼in. thick, would be 240lb.; if 5/16in. thick, 300lb.; if ⅜in. thick, 360lb.; this includes that portion of the plates housed when they are down. However, so much board is really not necessary, and quite sufficient hold of the water could be obtained by a smaller board.

In using either of these contrivances, the sails would have to be very carefully balanced by the centre of lateral resistance, and as the pressure would be greater on the fore part of the board, than on the aft part (see pages 15 and 23), it will, in practice, probably be found necessary to have the centre of effort considerably forward of the centre of lateral resistance, to bring about a balance. This really means that the fore board will be doing the greater portion of the work in holding the boat, and this question arises; had not the foreboard be better shifted further aft, and the other half of the board done away with altogether, and thus reduce the surface for friction to a minimum?

Numerous contrivances have been suggested to admit of the inside housing of the board being dispensed with altogether, and a very practical plan was proposed in the *Field* a short time ago. It consisted of a single plate of iron pivoted at the far end, and made to rest, when hauled up, on one side of the keel. An extension of this plan formed by adding to the plates and forming them into a kind of fan will be found illustrated by Fig. 37.

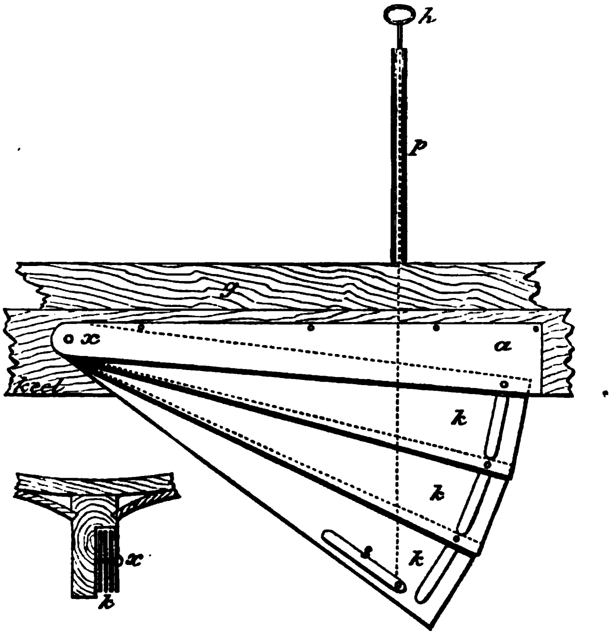


FIG. 37.

It will be seen that the leaves of the fan are pivoted to the side of the keel at *x*. The keel is cut away, and a plate, *a*, bolted over the chamber, so as to form a kind of box or case to take all the leaves when the fan is shut. See the small sketch. The leaves, *k*, *k*, *k*, are connected at their after ends by studs and slots. The fan is closed by a bar, working in a pipe *p*, as shown. The bar is attached to the lower leaf by a stud, which works in a fore and aft slot, *s*. The lifting bar should be jointed, so that when the fan is closed, the handle part, *h*, will fold down by the side of the pipe. The slots should be cut wide enough to ensure the studs working easily in them. The heads of the studs should be thin, and the edges nicely bevelled off. The number of leaves could be of course increased, but two would in most cases be probably found sufficient and less liable to get locked or jammed.

In 1870 a boat was built by Messenger, and called Wideawake, with a kind of shoe keel. The boat or rather canoe was 15ft. 10in. long, and 3ft. 2in. beam, depth, gunwale to keel, 1ft. 4in. She had an oak keel increasing in depth from 2in. forward, to 6in. aft. To this keel was fitted a hollow galvanised keel—a kind of case in fact to take the oak keel—12ft. long, made of ⅛in. iron (see Fig. 38). The keel was pivoted forward 4ft. from the stem plumb to load line. Care was taken to make the iron case fit the oak keel. The case was raised by a wire fastened to the stern end of the case, and passing through a tube as shown by A B, Fig. 39. The wire passed over a pulley on deck and was secured at mainmast. The keel weighed 28lb.

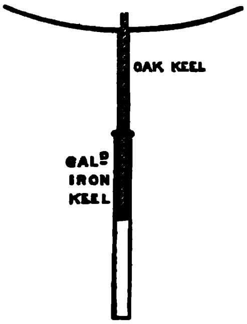


FIG. 38.

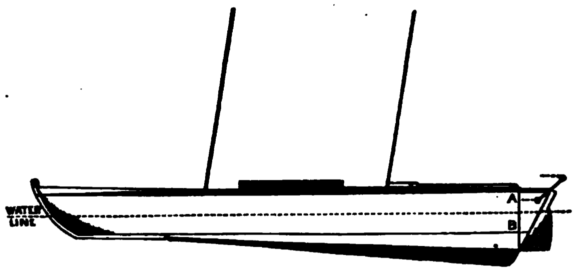


FIG. 39.

A better plan than the shoe keel was fitted a few years ago in a small boat, Robin Hood, by Searle, for Mr. W. B. Forwood. She had an oak keel 5in. deep, in the under side of which a slot 9ft. long and 3in. deep was cut; into this slot a galvanised iron plate ¼in. thick, 9ft. long, and 3in. deep was fitted. It was raised and lowered by a rod at each end, working in lead upright pipes.

Among the many curious contrivances to prevent leeway, one exhibited at the Exhibition of 1851 is as strange as any. The designer's idea appears to have been, that to obtain the greatest advantage in the way of stability, a yacht should be very broad and big above water, and very narrow and small under it (see Fig. 40); and that to get a large amount of lateral resistance, two keels should be had instead of one shaped longitudinally as shown by Fig. 41.

So far as the question of stability is concerned, we need scarcely say more than that it would be much increased if the greatest beam were put on the water line; but as the idea of parallel keels is continually cropping up, it may be well to point out that they cannot be of any advantage. In the first place, there is an extra surface for friction provided by the doubling of the keels, and as surface friction enters so largely into the aggregate resistance of a vessel, (see page 41) double keels should be condemned for this reason alone. Secondly, the actual increase in the lateral resistance would be only a very small percentage of the added surface, as the water would practically be locked up between the two keels, and so really out of the four sides of the keels, only one side (the leeward one of the leeward keel) would meet with lateral resistance.

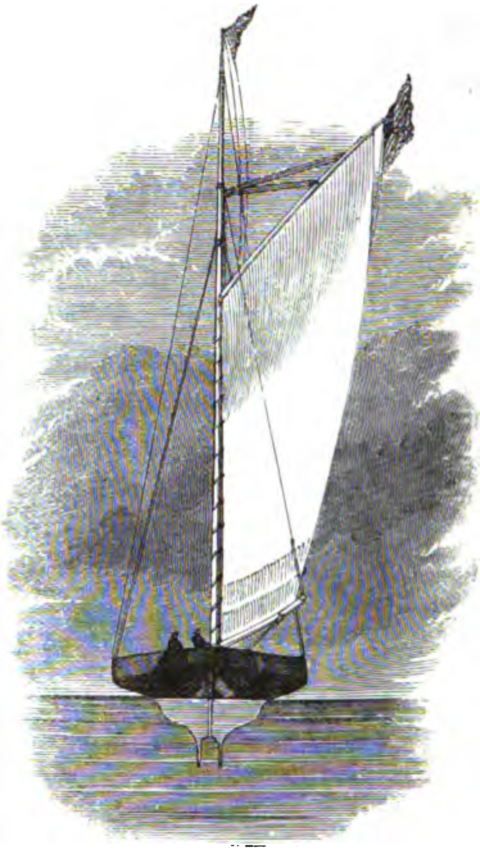


Fig. 40.

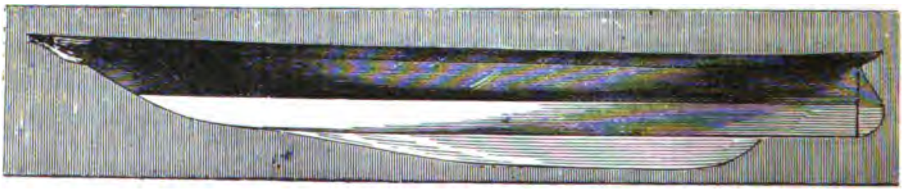


Fig. 41.

Among many other contrivances, the time-honoured lee-board may be mentioned, and the "horizontal keel," descriptions of both of which will be found at the end of the book.

CENTRE-BOARD BOAT FOR ROWING AND SAILING.

The boat most generally in quest on the Thames is the one for "rowing and sailing," or centre-board gig, which has been so laboriously described from time to time in *The Field*. This boat, for the man who likes the exercise of rowing and the pleasure of dodging a wind between the banks of a river, is admirably contrived. But he who has one need be content to limit his cruises to the water upon which she was intended to sail, until he has become a perfect master of the art of boat sailing. He should not be tempted into "cruises" down the river to Sea Reach, to Sheerness, Leigh, or Shoeburyness, as he may be "caught" in a nor'-wester; and then, if he has only been used to open-boat sailing in smooth water, and to very little of that, it may go hard with him. He will find it impossible, even supposing he can reef down and so far handle his craft as to tack her, to get to windward against a lee tide and yeasty sea; and the probability is that, even if the tide be a weather-going one, the sea will be so bad that she will be blown farther to leeward every tack than the tide will carry her to windward. Under these conditions there will be no alternative but to "up helm" and run for it; and, as it may be no more practicable to get into Sheerness than up Sea Reach, the situation of the "outward bound" boat sailer would be decidedly unenviable. Why not put her head to the sea and row her? she is a boat for rowing and sailing. Well, a man cannot row a boat head to sea with much success, and the need of doing so would be a rather severe argument against the sailing qualities of the boat. Then rig and throw overboard a floating anchor, ride to that, and wait till the turn of the tide. Very capital advice, and an old hand might do it, but not a frightened novice. The broad truth is, that a light centre-board gig, easy to row, and not an indifferent performer under canvas in smooth water, is not fit for open water where there might be a real sea—as different to the "magnificent furrows" of up-river as a chalk-pit is to a fox-hole; and even in the hands of a skilled boat sailer, such as a coast waterman, they would be out of place in Sea Reach under canvas.

The annexed diagram (Plate III.) shows a design for a centre-board gig which, whilst having fair sailing qualities, would be no great labour to row. The drawing is made to half-inch scale; but, as it is rather small to work from, the following tables can be referred to in laying off.*

---

* Full instructions for laying off are given in "Yacht Designing," but a brief outline of what has to be done can be given here. In the first place, the stem, keel, deadwood, and sternpost should be laid off full size; if a floor cannot be obtained long enough to lay the

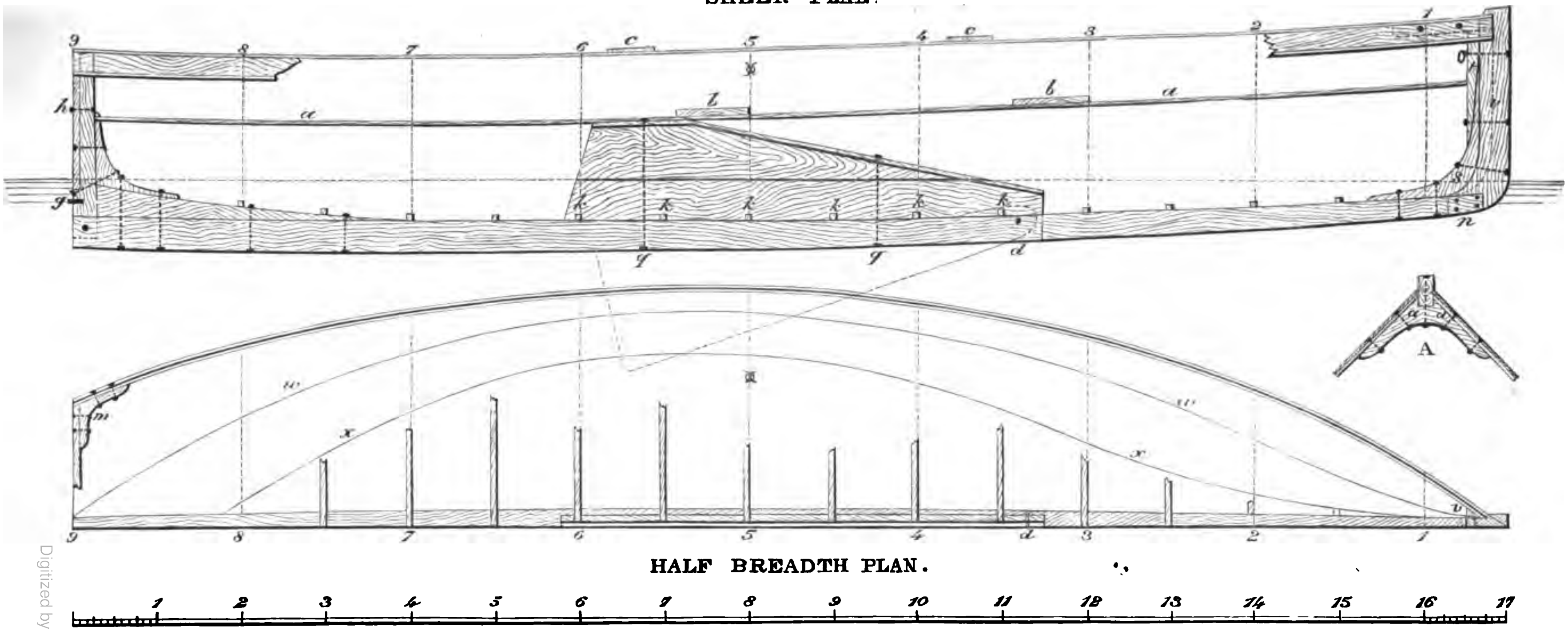
The references to the body plan (Plate 4) are as under : *w* is the load waterline (L.W.L.); *a a* 1 and *a a* 2; *b b* 1 and *b b* 2; *c c* 1 and *c c* 2 are "diagonals;" *o* is the middle vertical line, from which all distances are measured; *p p* are perpendiculars denoting the extreme breadth; *m m* is a kind of base line 10in. below the load-water line, and parallel thereto; *x*, is a water-line.

The numerals 1, 2, 3, 4, &c., denote the respective sections or timbers, and their stations in the sheer plan and half-breadth plan. No. 9 is the "transom," and of course will be a solid piece of wood, and not a "frame."

keel off in one piece, it can be divided in two or three pieces; or a floor can be improvised by placing a sufficient number of deals or planks together, both for the keel and body plan, When the floor is prepared, strike in the load water-line with a chalk line or straight edge; then, at right angles on either side of this line, set off by aid of an ∟ square all the sections 1, 2, 3, 4, &c. On each section mark off the distance from the load water-line to the top of the keel; and from the top of the keel to its under side. Place a batten (made of inch fir or American elm) over these marks or "spots," as they are called, and chalk in the shape of the keel. The batten can be kept in its place by a nail on either side of each spot. (Of course if the keel has no curve it can be laid off by a simple straight edge or chalk line.) The rounding up of the fore-foot can be obtained by putting in a couple of lines between No. 1 station and the fore-side of the stem, at right angles to the load water-line, and transferring the distances measured on these lines from the sheer plan to the floor. A mould out of a piece of half-inch fir can be made from the drawing on the floor, including stem, dead wood, and sternpost; but if the keel is to be cut out of a piece of American elm ten or twelve inches deep, then it can be laid off on the timber, striking the load water-line (or a line parallel to it) and sections as described. The remaining portion of the timber can be sawn into floors, &c. The body plan will be laid off by simply transferring the drawing from the paper to the floor. First, the load water-line *w* will be put in; then the middle vertical line *o*, and the perpendiculars *p p*; the base line *m* will follow; and then the diagonals *a*, *b*, *c*. The distances given for No. 1 section will be taken from the table and set off on the diagonals *a*, *b*, *c*, each distance to be marked by a "spot" or small cross on the diagonal; the *height* of the section from the load water-line to the gunwale, and the *depth* from the load water-line to the top of the keel, will be taken from the table or from the sheer plan; the *half breadth* of the section at the gunwale, and at the load water-line, will be taken from the table or from the half-breadth plan. All the "spots" having been put on the diagonals, and on the water line, and at the point representing the gunwale height and half breadth, a batten will be placed over the "spots," and its shape chalked in. The batten should be about 6ft. long, ¼in. deep, and from ⅜in. to 5/16in. thick. The batten will be kept to the "spots" by nails on either side of the batten, not through it. If the curve be unfair, the nails must be slightly shifted until the curve shows fair. If great accuracy is needed, the diagonals can be laid off in long lines to represent a Half-breadth Plan to further fair the design; this, however, will be scarcely necessary. Moulds will be made to represent each half section; but the midship mould and two others, Nos. 3 and 7, should be a whole one. The moulds can be made from rough ⅜in. deal. A piece 2in. wide will represent the middle line *o*, and the curved parts will be nailed together as required, and fitted with saw, plane, or spokeshave to the lines on the floor. The load water-line must be carefully marked on each mould, both on the perpendicular (*o*) and on the curve. Having got the building blocks in readiness, set up a line, by the aid of a spirit level, at a convenient height above them, to represent the load water-line—a straight edge would do. Put the keel on the blocks, and wedge it up until into its proper position with the load-water line. Then, having got the stem and sternpost into position, fix the representative load water-line to them inside, from the aft side of stem to fore side of sternpost. A chalk line should be struck up the centre of both stem and sternpost. The transom and the "full" moulds will then be adjusted and fixed at their proper stations. Presuming the rabbets to have been cut, the planking can be proceeded with, and the floors and timbers fastened in as the planking proceeds.

PLATE III.

SHEER PLAN.



HALF BREADTH PLAN.

17ft. Centre-board Boat for Rowing or Sailing.

LAYING OFF TABLE.

Nos. of Sections.	1	2	3	4	5	6	7	8	9
Sheer Plan and Half-breadth Plan.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	1 10¾	1 9½	1 8¼	1 7¾	1 6½	1 5¾	1 5¾	1 6	1 6½
Depths below load water-line to top of keel	0 2	0 3¾	0 4¼	0 5	0 5½	0 5¾	0 5½	0 5¼*	0 5
Depth of keel	0 3	0 3½	0 3½	0 3¾	0 4	0 4	0 4	0 4	0 4
Half breadths at gunwale	0 7	1 6½	2 2	2 7	2 9	2 8½	2 6	2 1	1 5½
Half breadths at L.W. L.	0 2¾	0 11¾	1 8½	2 3	2 5½	2 5¼	2 0½	1 3½	0 1½
Body Plan.									
Diagonal *a*	0 3¾	0 10½	1 2½	1 4½	1 6½	1 6¼	1 4¼	0 11½	0 3
" *b*	0 6½	1 6	2 1½	2 5½	2 7¾	2 7½	2 4¼	1 10¾	1 0¼
" *c*	0 9	1 11	2 7½	3 0½	3 2¾	3 2¼	2 11½	2 6	1 9

* Depth to top of dead wood, 3¾in.

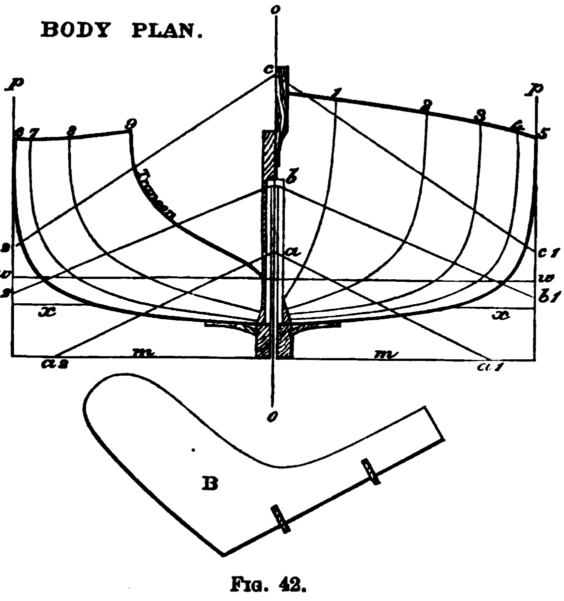


Fig. 42.

The distance *a* (Fig. 42), above the load water-line, *w*, is 3½in. measured on the vertical line *o*. The distances *a* 1 and *a* 2 from the vertical line *o*, measured along the horizontal line *m*, are 2ft. 3½in.

The distance *b*, above the load water-line (*w*), is 1ft.; *b* cuts the perpendicular *p* at *b* 1 and *b* 2, 2in. below the load water-line *w*.

The distance *c*, above the load water-line *w*, is 2ft. 2in; and *c* cuts the perpendicular *p* at *c* 1 and *c* 2, 3¾in. above the load water-line *w*.

x is a water-line struck 3in. below *w*, but will be of no assistance in laying off, as it does not intersect the frames sufficiently at right angles.

All the half-breadths, and the distances measured from the middle vertical line *o* along the diagonals to the various sections (as given in the tables), are *without* the plank; so in laying off *no allowance* will have to be made for the thickness of the plank.

The length of the boat is 17ft., and the breadth 5ft. 6in., and the extreme breadth, with the plank on, 5ft. 7½in. Weight of displacement of boat to L.W.L. about 12cwt.

The sections 1, 2, 3, 4, &c., are 2ft. apart, and No. 1 is 1ft. from the fore side of the stem at the L.W.L.

The frames actually will only be 1ft. apart; but every other one is left out in the Body Plan.

The scantling of the boat will be as follows: Keel, sided (thick) amidships 4½in., tapering gradually to 2½in. forward, and 3½in. aft. The moulded depths of the keel will be found in the table.

Stem, 2½in. sided; 4½in. moulded (*i e.*, its fore and aft thickness) at head, and 5½in. at knee scarph.

Sternpost, 3in. sided and moulded at heel; 2in. moulded at head.

Floors, ¾in. sided and 2in. moulded (deep) at heels, gradually tapering to ¾in. at heads. The floors will be fitted across the keel by ½in. joggles. Timbers at the sides and above floors, ¾in. square.

Plank, ½in. thick. Gunwales, 1in. thick, 1½in. deep.

Stringers (lettered *a* in the Sheer Plan) 1in. square, fastened through timber and plank. Seats and rowlocks as at *b b*, *c c*.

The centre-board or plate will be 5ft. 4in. long, pinned or pivotted in the keel below the garboard strakes, as shown in the Sheer Plan and Half-breadth Plan (Plate III.) at *d*, 5ft. 9in. from fore side of the stem at L.W.L. The slot in the keel to admit the plate will be 5ft. 7in. long by ⅜in. in width. The floors where this slot comes will have to be cut through. The heels of these floors will be fitted with ½in. joggles, and let in to the under side of the centre-plate case, as shown at *k k k k k k* in the Sheer Plan. One 4in. copper nail through each heel (outside the centre-plate case) will be sufficient to fasten these floors to the keel. (The case must be very carefully fitted to the shape of the keel, and luted with white lead.) The centre-plate case will be fastened through the keel by long galvanised iron (¼in.) bolts. The case will be made of inch pine; the plate of ⅜in. iron.*

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* Mr. J. C. Wilcocks gives the following instructions for fitting a centre board case: "If you can get a piece of plank 18in. broad out of which to make the case, so much the better; if not, put the broadest piece you can obtain for the lower portion, and the narrowest at the upper side. Select a piece—if possible without knots—of good sound pine; some use teak or mahogany, but it is unnecessary, although, if you keep the boat brightly varnished,

Sometimes the case is made of galvanised iron, and fitted into the slot. With such cases it will be best to fit a keelson over the heels of the floor, as at *k k*, &c., on either side of the case. These keelsons would

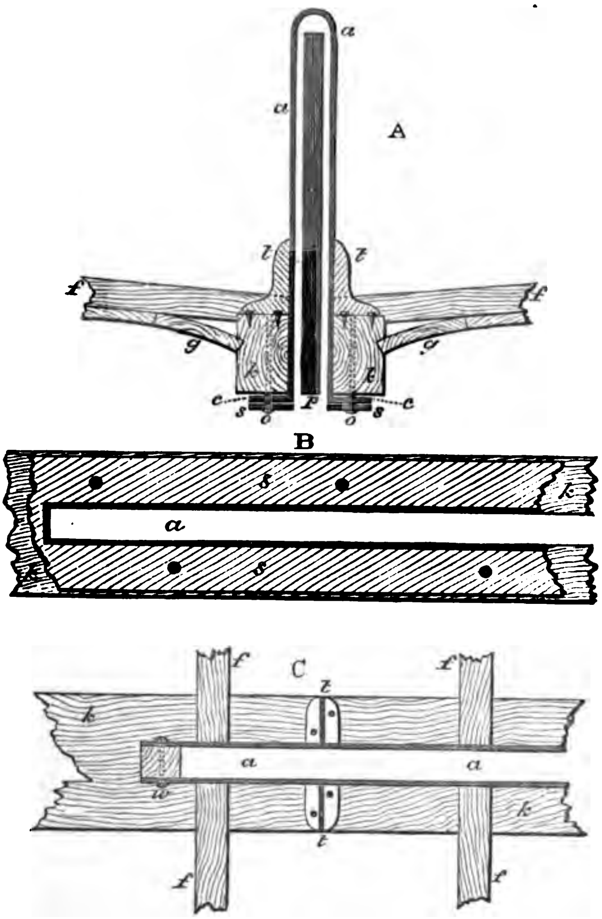

Fig. 43.

require to be about 3in. deep and 2in. broad, with one fastening between each pair of floors. However, as a rule, no such keelson is fitted, a couple

it is to be recommended. In making and fixing the case the most critical work is boring the planks through from edge to edge with a long gimlet like that used by bellhangers; this should be done in a horizontal position, a straight edge being laid on the plank occasionally, whereby to test the directness of the whole, and maintain the direct progress of the gimlet by bringing the straight edge over it, and observing whether the stem of the gimlet is parallel with the straight edge. I had four bolts of galvanised ⅜in. iron through each side, those near the extremities being 8in. from ends. These bolts had small heads on them and passed through the keel, where they were securely riveted on rings. A groove was made in each side of the case at the ends to take a piece of inch fir, which must be carefully fitted and luted with white lead; the slip of fir should be fastened through each side of the case, and the nails rooved and clinched."

of screws or nails in each heel of the floors being considered sufficient. The case would be prevented dropping through the slot in the keel by two small iron knees on either side, riveted to the case and fastened to the keelson.

Mr. W. Baden-Powell has furnished me with the following plan adopted by him in fitting a galvanised iron centre-board case. *a* (see sketch A, Fig. 43) is the iron case, passing through a slot in the keel and turned up underneath as at *c*. Over the lips *c* of the case, turned under the keel, an iron keel-band is fitted, as at *s* in Fig. A; and *s* in Fig. B shows the under side of this keel-band. Bolts are put through this keel-band, lips of the case, and keel, and fastened with washer and nut upon top of the keel as at *o o*. (The keel-band lips are shown a little apart for the sake of distinctness; of course, in construction all would be drawn close together.) Two small T angle-iron knees are fitted each side of the case (*a*), riveted through the case and screwed down to the keel *k*, as at *t t*. Without these knees the case is likely to get wrenched on one side or the other unless well secured to a thwart. To prevent leakage, a piece of tarred or varnished tape should be laid in the angle of the lips of the case before screwing it up with the keel-band. The latter can be made of inch or thicker iron, as it will serve as outside ballast.

Fig. C shows a view of the case and its fittings, looking down from the inside of the boat; *a* is the inside of the case; *k* the keel; *t* the iron knees; *f f* two floors. *w* is a piece of wood forming one end of the case, and through-bolted, as shown.

The dead wood, knee, and sternpost aft will be through-fastened, as shown in the Sheer Plan; and the sternpost should be tenoned into the keel. Forward the keel and stem will be box-scarphed into each other, and through-bolted, as at *n*. The apron (*s* in the Sheer Plan) will be bolted through keel and stem. The stemson *t* is a kind of filling-up piece, and serves as knightheads for additional plank fastenings forward. The upper through bolt in the stemson should have a ring through it, as shown.

The gunwale (which is equivalent to the clamp or shelf in a yacht, and rests on the timber heads) will be secured to the stem forward by "breasthook," as shown by *a*, diagram A (see Sheer Plan, Plate III.). This breasthook will have one fastening through the stem, and two through each gunwale and top strake, as shown. The gunwale and top strake will be secured to the transom by the knee, as shown at *m* in the Half-breadth Plan, through-fastened. A fastening will also be put through the gunwale and strake into the transom.

The floors should reach from the keel to three or four inches above the load water-line; and the timbers from the gunwale down the sides of the floors to within eight or nine inches of the keel.

The transom will be 1½in. thick, fitted at the back of the sternpost, as shown in the Sheer Plan.

The rudder will be shaped as shown by the diagram B (under the Body Plan, Fig. 42). Pintles will be dispensed with, and instead gudgeons and braces used, through which a brass rod will pass. This arrangement is necessary, as the rudder will hang considerably below the keel. If the braces are fitted over the gudgeons on the sternpost and a transom at *g h* (Sheer Plan), the rudder will lift on the rod if the boat drags on the ground, and will not unship.

The rabbet in the stem will be cut at about 2in. from the inner edges of the stem piece as shown by the ticked line *v* in the Sheer Plan. The rabbet in the keel (being a continuation of the rabbet in the stem) should be cut not less than one inch from the upper edge; and the same from the upper edge of the dead wood aft, and be deep enough to take a good fastening.

The boat will take about 4cwt. of ballast with three hands on board; this should either be in the form of shot bags, or flat bricks of lead cast to rest on the top of the floors, but sunk between them. These bricks would be under the platform or bottom board, which should be securely fastened, but at the same time be readily movable. If there is no objection to a cast-iron platform, the "bottom boards" can be dispensed with, and a thin iron slab cast to fit over the floors on either side of the centre plate. For such a boat as the design given the slabs would be 6ft. long by 1ft. 6in. broad, and 1½in. thick near the keel and ½in. nearest the bilge. They would be cast with grooves to fit the floors, and the grooves would gradually deepen from nothing at the bilge to ½in. in depth at the keel side. In the stern the usual bottom board or "stern sheet" would be fitted; and forward either a board or grating would be similarly fitted.

Of course, no plan of lead or iron ballasting will make such a shallow boat as the centre-board gig stiff, in the ordinary meaning of the word; and the large sails (plans of which will be given hereafter, with diagrams of other boats) should not be set unless two or three hands are on board to sit to windward.

The plate or board has been made rather smaller than is usual; but it has been found that a very large board, whilst it adds largely to frictional resistance, does not add proportionately to weatherliness. A very small piece of board will check the leeway tendency of a well-shaped and fast boat, and no doubt quite enough has been shown in the design.

A belief sometimes exists that a centre-board adds to the stability of a boat: so it does if made of iron or other metal, just the same as an iron or other metal keel would; but if the material be wood not heavier than water, the tendency of the board would be to upset the boat, as the wood would strive to come to the surface, or, in other words, to float: thus, the larger a wood board were made, and the deeper it were lowered, the more urgent would be its tendency to assist in upsetting a boat. A board, however, causes the process of heeling to be a little more slowly performed, as the board has to be moved through water, and the resistance to the board being so moved is of the same nature as the resistance of the water to any plane moved in it. Thus, when a boat is once permanently heeled, or has settled down on "her bearings," as it is termed, the board will be of no more use for stability, as its tendency will be to float or come to the surface. If the boat is struck by a squall which only lasts, say, four or five seconds, the board may possibly prevent an upset that otherwise would take place; but if the squall continues, and is of a strength to upset the boat without the board, the boat will be assuredly upset with the board, only it may take two or three seconds longer to do so.

The question of decking is one which will naturally arise in selecting a boat. No doubt a locker of some sort, to stow cushions, gear and sails in, is a desideratum in a boat; but a deck forward and aft, with waterways amidships, as shown in a sketch given farther on, must increase the weight, and for up-river sailing are quite unnecessary. However, if the boat-sailer is equal to the "stress and the strain of the wind and the reeling main," and can confidently knock about in Sea Reach, he will find the decks and waterways a great comfort. They will keep out all the water likely to lop on board, and nothing worse than spray need ever get into the well amidships. A partly decked boat with waterways, built by Messenger, of similar dimensions to the one we have given a design for (Plate III.), but fuller forward and aft, made a trip to Margate and back last autumn; and, whilst she behaved just as she ought in a breeze with some sea, she was not too heavy to row if occasion arose. However, trips to Margate from the Thames, or from Southampton to Portland, are not quite the work for centre-board gigs, and boats much better adapted for the purpose can be built.

A centre board boat, somewhat deeper, with more rise of floor, also with less length to beam, than the one of 17ft. length, may perhaps be a handier boat in narrow water, where frequent tacking is inevitable, and at the same time be not more laboursome to row. A diagram for such a boat is given on Plate IV., with body plan represented by Fig. 44, and, in order that the drawing may be utilised for boats of varying sizes, tables have been compiled to different scales, so that a boat of 10ft., 12ft., 15ft., or 20ft., can be built therefrom.

The displacement (or weight of water which the boat displaces when immersed to the load line, or, in other words, the weight of the boat, including everything she carries) of each boat, as given, is not mathematically correct, and need not be so considered; it is only given as a guide for the builder in ballasting, and it may be necessary or convenient to sail the boat lighter or deeper.* With regard to ballast, it will be found in practice that every passenger on board who sits to windward is of more value than an equal weight of ballast in the bottom of the boat would be. Of course there will be a limit to the number of passengers it is desirable to take in a boat of 12ft., and probably most men will conclude that one besides the helmsman is enough. When sailing in smooth water, shifting the ballast to windward can be largely indulged in if a practised hand besides the helmsman is on board to look after it; but in a sea the ballast should be well secured.

The sail dimensions given are for cruising, and are not so large as those of the gigs raced at Surbiton; the difference is about equal to one-seventh the linear dimensions—that is to say, the sail of the 14ft. boat, or any of the other boats given, would be one-seventh longer in the foot, one-seventh longer in the head, one-seventh longer on the luff, and one-seventh longer on the leech for a racing outfit.

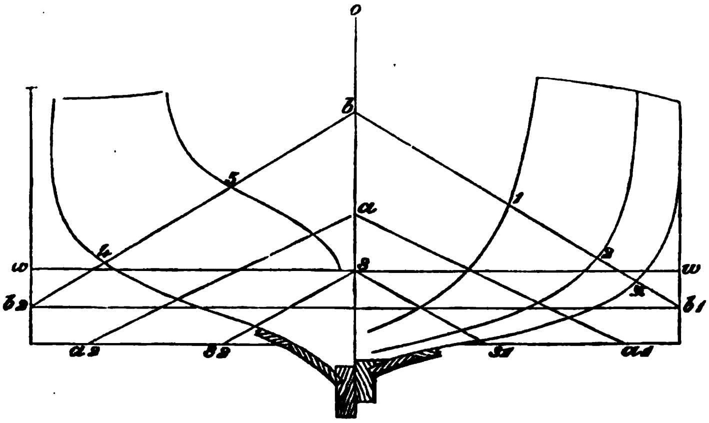

FIG. 44.

In all cases where measurements are given they must be adhered to, as the drawings are too small to work from, and "fairing" the moulds will be a matter of judgment.

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* The displacement of these boats can thus be found approximately: multiply the length on the load line by the beam on the load line, and the depth amidships to the rabbet of the keel; next multiply the product by the co-efficient 0·35 (see "Yacht Designing," page 76) and the product will be the displacement of the boat in cubic feet nearly. The co-efficient will of course vary according to the sharpness or fulness of the boat. The co-efficient for yachts varies from ·25 to ·4. The common co-efficient being ·32. There are 35 cubic feet of salt water in 1 ton.

BOAT OF 10FT.

	No. 1 Section.	No. 2 Section.	No. 3 Section.	No. 4 Section.	No. 5 Section.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Height above L.W.L. to gunwale	1 2⅜	1 1	1 0	1 0	1 1
Depths below L.W.L. to top of keel	0 4	0 5⅜	0 6	0 6⅜	0 7
Half-breadths at gunwale	1 0	1 7⅜	1 10⅜	1 9	1 0
Half-breadths at L.W.L.	0 7½	1 4	1 8	1 4½	0 1
Half-breadths *s* diagonal	0 5	0 8½	1 9¾	0 8	0 1
Half-breadths on *a* diagonal	0 8½	1 2⅜	1 4¾	1 1⅞	0 4
Half-breadths on *b* diagonal	1 0½	1 7⅜	1 10¾	1 8	0 10½

Distance No. 1 section is from fore side of stem			1ft. 7in.
„ No. 2 „	No. 1 section		1ft. 7in.
„ No. 3 „	No. 2 „		2ft. 2in.
„ No. 4 „	No. 3 „		2ft. 4in.
„ No. 5 (transom)	No. 4 „		2ft. 4in.

Diagonal *a* is struck 4in. above L.W.L., and *a* 1 and *a* 2 are 1ft. 7in. from the middle vertical line *o*. Diagonal *b* is 11in. above L.W.L. The diagonal *s* at *s* 1 and *s* 2 is 9½in. from the vertical line *o*.

Length, 10ft.

Breadth, 3ft. 9in.

Pin of centre plate from fore side of stem, 3ft. 3in.

Length of plate on top edge, 3ft. 6in.

Length of plate on under edge, 3ft. 10in.

Greatest breadth of plate, 1ft. 2in.

Least breadth of plate, 4½in.

Thickness of plate, ⅜in.

Weight of plate, 40lb.

Weight of displacement of boat when immersed to L.W.L., 3¾cwt.

Weight per inch of immersion at L.W.L., 1cwt.

BALANCE LUG SAIL (see FIG. 45).

Mast, thwart to sheave hole	10ft. 0in.
Luff of sail	4ft. 0in.
Leech	13ft. 3in.
Foot	10ft. 0in.
Head	10ft. 3in.
Tack to peak earing	14ft. 6in.
Clew to weather earing	10ft. 0in.
Area of sail	80 square ft.

BOAT OF 12FT.

	No. 1 Section.	No. 2 Section.	No. 3 Section.	No. 4 Section.	No. 5 Section.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	1 5⅜	1 3½	1 2½	1 2½	1 3⅜
Depths below L.W.L. to top of keel	0 4¾	0 6	0 7	0 7⅜	0 8
Half-breadths at gunwale	1 2⅜	2 0	2 3½	2 1⅜	1 3
Half-breadths at L.W.L.	0 8¾	1 7	2 0	1 7⅜	0 1½
Half-breadths *s* diagonal	0 6	0 10	0 11⅜	0 9⅜	0 1¾
Half-breadths on diagonal *a*	0 10	1 5½	1 8	1 4⅜	0 4½
Half-breadths on diagonal *b*	1 2⅜	1 11⅜	2 3¾	2 0	1 0⅜

No. 1 section is 2ft. from the fore side of stem.
No. 2 section is 2ft. from No. 1.
No. 3 section is 2ft. 6in. from No. 2.
No. 4 section is 2ft. 9in. from No. 3.
No. 5 (transom) is 2ft. 9in. from No. 4.

Diagonal *s* at *s* 1 and *s* 2 is 11½in. from the middle line *o*.

Height of diagonal *a* above load line, 4¾in.; *a* 1 and *a* 2 are from the middle line *o*, 1ft. 11in.

Height of diagonal *b* on middle line *o* of Body Plan above L.W.L., 1ft. 1½in., and at *b* 1 and *b* 2 is 3in. below L.W.L.

All the half breadths given are without the plank.

Length from fore side of stem to aft side of transom, 12ft.

Greatest breadth moulded (*i.e.*, without plank), 4ft. 7in.

Aft side of mast from fore side of stem, 3ft.

Weight of displacement of boat when immersed to load line, 6cwt.; weight per inch of immersion, 1½cwt.

Pin of centre plate from perpendicular at fore side of stem, 3ft. 11in.

Length of plate on its under edge, 4ft. 8in.

Length on its upper edge, 4ft. 3in.

Greatest breadth of plate, 1ft. 4in.

Least breadth, 5½in.

Thickness, ⅜in.

Weight of plate, 50lb.

Siding (thickness) of keel amidships, 4in.; ditto at stem, 2in.; ditto at sternpost, 2½in. Moulded depth of keel, 3½in.

BALANCE LUG SAIL (see FIG. 45).

Mast, thwart to sheave hole	10ft. 0in.
Luff of sail	5ft. 6in.
Leech	16ft. 0in.
Foot	12ft. 0in.
Head	12ft. 3in.
Tack to peak earing	17ft. 6in.
Clew to weather earing	12ft. 0in.
Area	105 square ft.

Halyards bent to yard, 5ft. from lower end.
Tack, 1ft. 6in. from fore end of boom.

BOAT OF 14FT.

	No. 1 Section.	No. 2 Section.	No. 3 Section.	No. 4 Section.	No. 5 Section.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	1 8½	1 6	1 5	1 5	1 6
Depths below L.W.L. to top of keel	0 5¾	0 7	0 8	0 8¾	0 9½
Half-breadths at gunwale	1 5½	2 4	2 8	2 6	1 5½
Half-breadths at L.W.L.	0 10½	1 10¾	2 4½	1 10½	0 1½
Half-breadths *s* diagonal	0 6½	1 0	1 1¼	0 11	0 1½
Half-breadths on diagonal *a*	1 0	1 8½	1 11¾	1 7½	0 5¾
Half-breadths on diagonal *b*	1 5½	2 3¾	2 8½	2 4½	1 3

No. 1 section is 2ft. 4in. from the fore side of stem.
No. 2 section is 2ft. 4in. from No. 1 section.
No. 3 section is 2ft. 10in. from No. 2 section.
No. 4 section is 3ft. 3in. from No. 3 section.
No. 5 (transom) is 3ft. 3in. from No. 4 section.

Diagonal *a* above L.W.L., 5¾in.; *a* 1 and *a* 2 from middle line *o* (see Body Plan, Fig. 44), 2ft. 3in.; diagonal *b* above load line, 1ft. 4in., and at *b* 1 and *b* 2 is 3½in. below the L.W.L.; diagonal *s* at *s* 1 and *s* 2 is 1ft. 1½in. from the middle line *o*.

All the half-breadths given are without the plank.

Length from fore side of stem to aft side of transom, 14ft.

Greatest breadth moulded (*i.e.*, without the plank), 5ft. 4in.

Aft side of mast from fore side of stem, 3ft. 6in.

Weight of displacement of boat when immersed to load line, 8cwt.

Weight per inch of immersion at load line, 1¾cwt.

Pin of centre plate from perpendicular at fore side of stem, 4ft. 6in.

Length of plate on its under edge, 5ft. 5in.

Length on its upper edge, 5ft.

Greatest breadth of plate, 1ft. 6in.

Least breadth, 6in.

Thickness of plate, ¼in.

Weight of plate, 110lb.

Siding (thickness) of keel amidships, 4in.; ditto at stem, 2½in.; ditto at sternpost, 3in. Moulded depth (*i.e.*, depth from top to under side), 4in.

BALANCE LUG SAIL (see FIG. 45).

Foot	14ft. 0in.
Head, measured along the ticked line (*a*)	14ft. 3in.
Leech	19ft. 9in.
Luff	6ft. 0in.
Tack to peak earing	21ft. 0in.
Clew to weather earing	14ft. 8in.
Area	155 square ft.

Yard is slung 6ft. from lower end. Tack is bent 1ft. 9in. from fore end of boom.

BOAT OF 15FT.

	No. 1 Section.	No. 2 Section.	No. 3 Section.	No. 4 Section.	No. 5 Section.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	1 10	1 7½	1 6	1 6	1 7½
Depths below L.W.L. to top of keel	0 6¾	0 7¾	0 8¾	0 9¾	0 10
Half-breadths at gunwale	1 6¾	2 6	2 10	2 8	1 7
Half-breadths at L.W.L.	0 11	2 0¾	2 6½	2 0½	0 1½
Half-breadths *s* diagonal	0 7	1 0½	1 2¾	0 11½	0 1½
Half breadths on diagonal *a*	1 1	1 10	2 1	1 9	0 5½
Half-breadths on diagonal *b*	1 6½	2 6	2 10½	2 6½	1 4

No. 1 section is 2ft. 6in. from the fore side of stem.
No. 2 section is 2ft. 6in. from No. 1 section.
No. 3 section is 3ft. 1½in. from No. 2 section.
No. 4 section is 3ft. 5½in. from No. 3 section.
No. 5 (transom) is 3ft. 5½in. from No. 4 section.

Diagonal *a* above L.W.L., 6¼in.; *a* 1 and *a* 2 from middle line *o* (see Body Plan, Fig. 44), 2ft. 4½in.; diagonal *b* above load line, 1ft. 5in., and at *b* 1 and *b* 2 is 3¾in. below the L.W.L.; diagonal *s* at *s* 1 and *s* 2 is 1ft. 2½in. from the middle line *o*.

All the half-breadths given are without the plank.

Length from fore side of stem to aft side of transom, 15ft.

Greatest breadth moulded (*i.e.*, without the plank), 5ft. 8in.

Aft side of mast from fore side of stem, 3ft. 9in.

Weight of displacement of boat when immersed to load line, 10cwt.

Weight per inch of immersion at load line, 2cwt.

Pin of centre plate from perpendicular at fore side of stem, 4ft. 9in.

Length of plate on its under edge, 5ft. 10in.

Length on its upper edge, 5ft. 4in.

Greatest breadth of plate, 1ft. 9in.

Least breadth, 6in.

Thickness of plate, ½in.

Weight of plate, 130lb.

Siding (thickness) of keel amidships, 4½in.; ditto at stem, 2½in.; ditto at sternpost, 3in. Moulded depth (*i.e.*, depth from top to under side), 4in.

BALANCE LUG SAIL (see FIG. 45).

Foot	14ft. 0in.
Head, measured along the ticked line (*a*)	15ft. 3in.
Leech	20ft. 0in.
Luff	7ft. 0in.
Tack to peak earing	21ft. 6in.
Clew to weather earing	15ft. 6in.
Area	168 square ft.

Yard is slung 6ft. 3in. from lower end. Tack is bent 2ft. from fore end of boom.

BOAT OF 20FT.

	No. 1 Section.	No. 2 Section.	No. 3 Section.	No. 4 Section.	No. 5 Section.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	2 6	2 2	2 0	2 0	2 1
Depths below L.W.L. to top of keel	0 5	0 6¾	0 11½	1 0	1 0¾
Half-breadths at gunwale	2 0	3 4	3 9	3 6½	2 1
Half-breadths at L.W.L.	1 3	2 8½	3 5	2 8	0 1¾
Half-breadths *s* diagonal	0 10	1 5	1 7½	1 4	0 1¾
Half-breadths on diagonal *a*	1 5	2 5½	2 9¼	2 4½	0 7
Half-breadths on diagonal *b*	2 0½	3 4	3 10½	3 4¾	1 9½

No. 1 section is 3ft. 4in. from the fore side of stem.

No. 2 section is 3ft. 4in. from No. 1 section.

No. 3 section is 4ft. 2in. from No. 2 section.

No. 4 section is 4ft. 7in. from No. 3 section.

No. 5 (transom) is 4ft. 7in. from No. 4 section.

Diagonal *a* is 8in. above L.W.L., and *a* 1 and *a* 2 are 3ft. 3in. from the middle line *o*. Diagonal *b* is 1ft. 11in. above L.W.L., and at *b* 1 and *b* 2 is 5in. below L.W.L.; diagonal *s* at *s* 1 and *s* 2 is 1ft. 7½in. from the middle line *o*.

All the half-breadths given are without the plank.

Length from fore side of stem to aft side of transom, 20ft.

Greatest breadth moulded, 7ft. 3in.

Aft side of mast from fore side of stem, 4ft. 10in.

Weight of displacement of boat when immersed to load line, 1 ton 6cwt. (1·4 ton).

Weight per inch of immersion, 4cwt. at load line.

Pin of centre plate from perpendicular at fore side of stem, 6ft. 3in.

Length of plate on its under side, 7ft. 6in.

Length on its upper side, 6ft. 9in.

Greatest breadth of plate, 2ft. 0in.

Least breadth, 9in.

Thickness of plate, ½in.

Weight of plate, 200lb.

Siding (thickness) of keel amidships, 5in.; ditto at stem, 3in.; at sternpost, 3½in. Moulded depth of keel, 6in.

BALANCE LUG SAIL (see FIG. 45).

Mast, thwart to sheave hole	**15ft. 6in.**
Luff of sail	**10ft. 0in.**
Leech	**27ft. 0in.**
Foot	**20ft. 0in.**
Head	**20ft. 6in.**
Tack to peak earing	**30ft. 0in.**
Clew to weather earing	**20ft. 0in.**
Area of sail	**300 sq. ft.**

The 10ft. boat, planked with ⅜in. mahogany, would weigh, inclusive of centre-plate and case, sails, and spars, about 2cwt. Thus it would take ½cwt. of ballast and one person of 8st. (1cwt.) to bring her down to the intended load line; but she might with advantage carry one more passenger or 1cwt. more ballast. Every additional cwt. would sink her an inch deeper; but it is of little use crowding a large quantity of ballast in a shallow boat in the hope of making her stiff. For light rowing the plate, ballast, and sails could be removed.

The 12ft. boat, inclusive of sails, spars, and plate and case, would weigh, with the same thickness of plank, about 2½cwt., and should have at least 2cwt. of ballast, or one person and 1cwt. of ballast, besides the helmsman, for sailing with the large balance lug sail.

The 14ft. boat with ½in. plank, and including centre plate and case, spars, and sails would weigh about 3¼cwt., and would require from 3cwt. to 4cwt. of ballast, according to the number of passengers on board.

The 15ft. boat would be planked with ½in. stuff, and would weigh, inclusive of centre-plate and case, spars and sails, about 3¾cwt., and would require 3cwt. or 4cwt. of ballast, according to the number of passengers on board.

The 20ft. boat would weigh, inclusive of centre-plate and case, spars and sails, about 7cwt. To get her down to the load line, she would take four passengers of 12st. each, and about half a ton of ballast. As such a large boat is not adapted for rowing (excepting on emergencies), it would be advisable to have 5cwt. of iron cast in the form of a keel, with a slot in it for the centre-plate to work in. An iron keel, 12ft. long, with an average width of 4in. and depth of 3½in., would weigh about 5cwt. The iron keel forward would extend as far as the mast and aft to within 3ft. of the stern post. A filling-up piece of wood, well rounded up towards the stern post, will finish the keel off aft, and the same forward tapering to "nothing" at the scarph of the keel with the stem. The iron keel should be 4½in. deep in its mid length, and 3in. at either end. Transversely it would, of course, taper to match the taper of the under side of the wood keel. The best cruising rig for such a boat would be the balance lug, foresail, and mizen, of about the extreme proportions given for the 17ft. boat (Plate V.); but the mast should be stepped one foot farther aft, and the boomkin for the foresail should be shortened one foot.

Centre-board boats such as shown in the diagram are peculiarly adapted for shifting-ballast, as the centre-plate case makes a kind of fore-and-aft bulkhead which will always prevent the ballast sliding to leeward. Still, sliding is not the only danger accompanying the practice of shifting ballast. If a man is single-handed, he might be unable in an emergency to trim his shot bags or other dead weight in time, or his mate may be unable to do so; and it cannot be too often impressed upon the young boat sailer that he must well look after loose ballast in the bottom of a boat (secure it if possible), and never be tempted into carrying a lot of sail on the strength of the ballast being shifted to windward.

SAILS FOR CENTRE-BOARD BOATS.

Opinions are very much divided as to the best kind of rig for a centre-board gig; but, at any rate, the balance lug in some form or other appears to be most generally in favour. It has been contended that a boat rigged with a single balance lug is likely to miss stays, and this is perhaps true in what is termed a "lop;" but a boat with one large sail in the hands of a clever boat sailer, need never miss stays in smooth water at least, unless the wind headed the boat round, and then of course she would miss stays, whatever her rig. It is an advantage to have the sail all in one piece for going to windward—tacking out of the question—and for a single hand it is of course convenient to have no head sails to work. No description of boat will stay quicker or with more certainty than the American cat-boat, or Una, and, if not brought head to wind by too free a use of the rudder, they lose very little way in tacking.

On the other hand, a boat with one sail may fail to go about in a disturbed sea, and may get in irons; whereas if she had a foresail the operation of tacking, without getting stern way on, might have been successfully performed by keeping the head sheets aweather. A clever boat-sailer will always work his head sheets without inconvenience even in a lop, as he will see his craft safely filling on the opposite tack before he attempts to "let draw," and, as the head sheets will lead aft, he need not move from his seat. The argument *pro* and *con.* the foresail can, therefore, be summed up thus: In light winds it is an advantage to have the sail all in one piece, especially for beating, and the trouble of working head sheets does not exist; but in strong winds and rough water there will be more security in a smaller mainsail, with the addition of a headsail; and, although there will be the trouble of working the head sheets, there need be no difficulty about it even for one hand. Concluding that it is "safest to be safe," it will be best to be provided with a foresail for sailing in rough water.

Another very strong argument in favour of the foresail or jib in addition to the balance lug is this; if there be much wind, the boat when sailing "along," or off the wind, will exhibit a very great tendency to come to against her helm, that is, she will require a great deal of weather helm to keep her out of the wind; this tendency will be greatly relieved by the jib. Again, if there be any sea, the boat will have to be constantly "chucked" up in the wind to avoid a comber that may be coming in on the weather bow, for it will not do to sail boats very hard in rough water; yet must they be kept full, and to avoid getting into irons after luffing to a comber, or to meet a heavy puff, a foresail will be found very useful. The foresail can either be set on a bowsprit or bumpkin, as shown in Plate V. The manner of fixing the bumpkin will be found described in the chapter on Itchen boats.

Many experienced boat sailers recommend a mizen instead of a foresail, and they argue that a mizen can be made as great a help to a boat's staying as a foresail. There is not much doubt that a mizen is a powerful lever to insist in throwing a vessel's head to wind; but it is of no use for paying a boat's head off, if she gets in irons. However, as shown in Mr. Baden Powell's sketch, if the tiller is carried aft (say 2ft.) of the rudder, to act as a mizen bumpkin, then each time the tiller is put down, or to leeward, the mizen will be brought to windward and push the stern round. This may be so, and, if the boat kept moving through the water, she would no doubt ultimately describe an arc of a quadrant through the wind acting on the mizen; but when a boat is in irons she does not move through the water—at least not ahead, although she may get stern way on. Now if the mizen is kept across the boat whilst she is in irons, it will, if it has any effect at all, drive her astern as well as tend to push the stern on one side. As the latter motion will be counteracted by the direction the rudder is necessarily turned (presuming that the boat is making stern way), we doubt if the mizen can be manœuvred so as to be of much service in the case of a boat that has no head sail getting into irons. In fact, the proper thing to do, if a boat in a "lop," when under main and mizen sail, did get into irons, would be to let the mizen sheet go, or reverse the helm, and then haul the mainboom over to the side which is to be the weather one when she has filled; then, with stern way on, the boat's head will be boxed off, and she may be helped by a timely kick from a cross sea. Thus far the conclusion is forced upon us that, if two sails are decided upon, the foresail and mainsail have a slight advantage over the mizen and mainsail.

There may possibly be some advantage in open water in the main and mizen rig, if warning of a "kick-up" has not been taken advantage of to reef. Going into the eyes of an open boat to reef her foresail in a "lop" is by no means a pleasant or safe operation to perform, and indeed it should not be attempted unless a counterbalancing weight is put in the stern; the boat will then plunge violently, but there will be less danger of her being swamped. Now, with the main and mizen rig there will be no foresail to reef, and as the mainsail will be all in board, reefing when *in extremis* will be a comparatively easy operation. Again, if the mainsail has to be lowered in a hurry, the mizen will bring the boat to the wind, instead of taking her off as a foresail might. But the danger as last indicated can easily be avoided by letting go the head sheets before lowering the mainsail. Then the foresail might be found of service for scudding before a strong wind at sea. On the other hand, the mizen might be of use in rowing, in keeping the boat's head to the wind at sea. However, as snugging down should be never deferred, with a rising storm, until the sea got up so as to make reefing a foresail a matter of danger, we still cast in favour of the sloop or main and foresail rig.

The question here naturally arises, if the mizen is of use as well as the foresail, why not have both? We certainly do not see why both should not be had; and, if the wind is so strong as to necessitate the mainsail being stowed, the boat will be fairly handy and manageable under mizen and foresail, although the canvas would scarcely be large enough to get her to windward with the wind dead on end.

The fashion of lacing the sail to a boom is now general whatever the rig, and no doubt the plan has many advantages—the principal of which are that the foot can be kept straighter, and thereby the sail generally flatter, and in easing the sheet little or much the sail does not go into a bag; on the other hand without the boom, if the boat be struck by a squall, the wind will be spilled from the sail directly the sheet is loose; but the case is different with a boom sail; and if the squall be heavy it will be necessary to luff the boat up in good time as well as ease the sheet, and prepare to lower the sail in case the squall should not abate.

To the question of how much sail it is prudent to give an open boat, the answer very much depends upon the requirements and capabilities of the boat-sailer. Sail areas of open boats, we find, vary very considerably; and in proportion to the length of boats multiplied by breadth, range from 1 to 3.* Thus we find some cruising gigs, 17ft. long by 5ft. 6in. in beam (equal to 93·5 square feet), with about 90 square feet of canvas in their sails; whilst other boats, only 14ft. by 5ft. 3in, that are raced, have sail areas of 180 square feet. The latter proportions will only be safe in the hands of an expert, and the novice should begin with very small sails.†

Sometimes in the sloop rig the jib or foresail, instead of being tacked outboard to a bumpkin, is laced at its foot to a boom; the sail is then "tacked" by this boom to the stem head, so much sail being forward of the stem as the space between the mast and the stem requires. A pair of sheets are required as usual, and the *weather* one should always take the weight of the sail; the lee one is consequently slack, but only so slack that when the boat is put about it takes the strain as the weather sheet. Thus the sheets need no trimming in tacking. The objection to this "revolving jib" is that it cannot be readily "spilled," as after the sheet is gone the sail will sometimes be balanced by the wind; hence the sail may not only be an inconvenient one, but a dangerous one. This objection can be somewhat removed by having the tack fast some distance ahead of the centre of length of the boom.

The "balance lug," Fig. 45—which was introduced at Surbiton by Mr. Burgoine (boat builder, of Kingston-on-Thames), about twelve years ago—is a sail so arranged that it requires no dipping in going about; that is, it lies on the mast on one tack, and from the mast on the other.

The boom and yard are generally of about the same length, and the length of the mast is in a measure governed by the amount of peak, or round, given to the head of the sail. If the yard is slung in its amidships, the sail should have great peak, and it will stand or sit better than if the sail be cut flat-headed. If the yard be slung nearer its lower end than amidships, the sail, if not cut with a high peak, is apt to sag to leeward; and the same might happen if the sail be very flat-headed and slung, say, one-third of the length of yard from the lower end or heel of yard. A good place for the slings of a well peaked and round headed sail will be about one-tenth the length of yard from its amidships. (The head and foot of the sails are always laced to yard and boom.)

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* Rules for finding the areas of sails are given in "Yacht Designing;" but we have found that the following simple rule gives sufficiently accurate results for all practical purposes: Multiply the length of the sail from the tack to peak earing by the length from the clew to weather earing, divide the product by 2, and the quotient will be the sail area nearly.

† The most successful gigs that compete in the matches of the Thames Sailing Club have enormous sail areas, all in one piece as a balance lug. These sail areas frequently equal three times the area, found by multiplying the length of the boat by the beam; and the boats, being dexterously handled, carry the sail well, and appear wonderfully handy. Of course it would be madness for a mere tyro to think of handling such a sail, even with plenty of live ballast on board. The most handy size for match sailing up river, where short boards only can be made with the wind "dead on end," appears from experience at Surbiton to be the 14ft. boat, and they are given as much as 5ft. 3in. beam to enable them to carry large sails. One of these boats has a sail of the following dimensions: Luff, 9ft.; leech, 22ft.; foot, 17ft.; head 16ft.

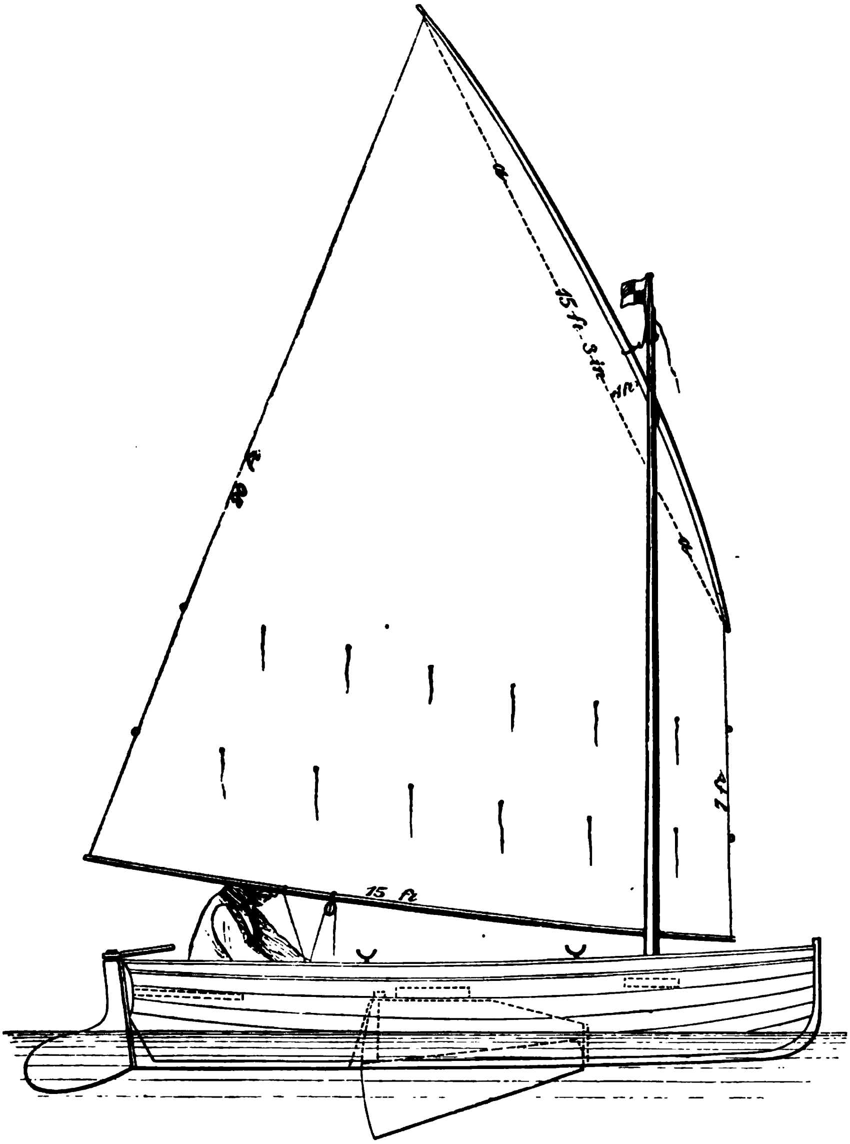


Fig. 45.

A Surbiton boat, however, has the yard slung at about two-fifths its length from the lower end, but then the head of the sail has not so much round as shown in the diagram. However, a squarer sail and a better standing one can be obtained by slinging the sail nearer amidships and giving as much round to the head, as shown in the drawing; the luff will be shorter than is generally given, but this probably will be found an advantage.

About one-seventh of the foot of the sail should be forward of the mast, and in slinging the yard and in bending the tack to the boom care must be taken that this proportion is not much exceeded. If too great a proportion of the sail is put forward of the mast it will not "balance," and in luffing to squalls, especially with the boom off the quarter, it will be found that, although the boat may come to a little, the sail will not spill. This peculiarity may be attended by some danger in the case of squalls or in clearing an obstacle, and may be accounted for by the fact that the ardency of the wind pressure on the fore part of the sail will be so great that it will more than balance the pressure on the greater area of the after-part, which, with the aid of the rudder, should bring the boat head to wind. (See page 23.)

No rig is handier for tacking in smooth water than the balance lug, and should a boat so rigged by any mischance show a tendency to miss stays or get in irons, her head can easily be paid off by holding the foot of the sail over to the side which is to be the weather one. This, of course, will stop the boat, and press her bodily to leeward or force her astern, and the sail should never be kept a-weather a moment longer than is necessary. Should the boat not gather way again quickly after the boom has been put over on the lee quarter again, the main sheet must be eased a trifle.

The sail is hoisted by a single halyard; to one end of this halyard a block is spliced; the other end is rove through a sheave hole in the mast head and bent to the yard; through the block a rope is rove, the standing part of which is made fast to the mast thwart and the hauling part through a block at the mast step. This forms a whip purchase, but if the sail be a large one a gun tackle purchase is used. The halyard is bent or hooked to a thimble-eye strop on the yard. The sail can be kept to the mast by a parrel thus contrived: a grommet strop, with thimble-eye seized in it, will be put on the yard about 6in. above the slings; another similar strop will be put on the yard at about 2ft. 6in. (for a 14ft. boat) below the slings; a line must be spliced to the lower thimble, and rove through the upper one round the aft side of the mast, back through the lower thimble. Thumb cleats must be put on the yard to prevent the strops slipping. When the sail is set, the line must be hauled as taut as it can be got and belayed.

But a neater plan than this is the mast iron, as shown in the diagram; the halyard is fast to an eye in the iron, and the latter is hooked to the thimble eye strop on the yard. The disadvantage of the iron traveller is that the tack and sheet of the sail must be let go when the sail has to be lowered, or otherwise the sail will not lower. As the sail comes down the fore-end of the boom must be carried forward.

If an iron mast traveller be used the yard will be slung as shown in Fig. 45; if a parrel be used instead of the iron, the yard will be slung a little lower down, as the strop will be hauled close up to the sheave hole; consequently the sheave hole will be a little lower down, and the mast may be a trifle shorter.

A downhaul should always be bent to the yard.

The tack will be bent to the boom abreast of the mast and lead through a block, either on mast thwart, or deck, as may seem most handy. The Surbiton plan for the tack is thus worked: a thimble is stropped to the boom abreast of the mast, and to the thimble 5ft. or 6ft. of line is spliced; the line is passed once round the mast, back through the thimble, then through a galvanised iron eye-bolt screwed into the mast some convenient distance below, and belayed to a cleat on the mast. For a 15ft. boat a gun tackle purchase should form the tack. In setting the sail it is often found that the luff can be got tauter by swigging on this tack than by hauling on the whip purchase of the halyards.

If topping lifts are used (they may be handy whilst reefing, or to brail the sail up), one part will be made fast to the masthead and lead across the sail, and through a thimble made fast under the boom by a seizing (or it can pass through the thimble in the strop of the main-sheet block) and up the other side of the sail, through a block at the masthead and the "fall" down by the side of the mast.

A wire forestay is generally set up to the stem head, and it is better that a gun-tackle or double-block purchase should be used for the setting up instead of a lanyard, as the mast (sails and all) can be lowered by it for passing under bridges, &c. The mast should be stepped in a tabernacle, which tabernacle will be open on the aft side and fitted in the aft side of the mast thwart. The forestay will go over the masthead by an eye; a thimble eye will be at the other end of the stay to take the lanyard or hook of the setting up tackle. There will be a single wire shroud each side of the mast fitted the same as the forestay, but set up by lanyards to the eyes of neat chain plates fitted to the gunwale. Sometimes, however, the lanyard is rove through a thimble seized to the thwart or to a timber, or through a thole hole in a rowlock.

The main sheet is arranged thus; standing part fast to the boom, then through a single block under one gunwale, then through a block stropped to boom and belayed under the other gunwale; for the 10ft. boat thimbles might be used instead of the blocks.

In the 10ft., 12ft., and 14ft. boat, the "Una" plan of main sheet may be suitable. An end of the sheet is fast to one quarter; the other passes through a block on the boom, and through another block on the opposite quarter. For sailing on a wind it may be found that with the blocks on the gunwales the boom cannot be hauled in flat enough; so unless the blocks are on the transom at the extreme stern the blocks should be fitted inside the gunwale. Another plan is to have the standing part of the sheet fast to the extreme end of the boom; other end through a double block with traveller on a horse; then through a single block on boom back through the double block, and belay by hitching the hauling part round the parts of the sheet above the double block.

Some of the Surbiton boats have the mainsheet thus fitted: A single block on main boom and one on a horse, also one on the deck a little ahead of the horse. The sheet is fast to the block on the boom, then leads through the block on the horse, back through the block on the boom, through the block on deck, and belay.

Another form of the lug or settee sail is shown in Plate V., adapted from the lugs used in the boats belonging to the New Brighton Sailing Club. (A detailed description of the rig will be given further on.) The dimensions and areas of the sails adapted for the 17ft. boat are as follows:—

Mainsail.

	ft.	in.		ft.	in.
Head (measured along the yard)	15	0	Luff	3	3
Leech	18	0	Tack to peak earing	17	0
Foot	11	9	Clew to weather earing	13	0

This sail is drawn with 1ft. 4in. round to the head.

Foresail.

	ft.	in.		ft.	in.		ft.	in.
Leech	8	6	Foot	6	6	Luff	10	9

Mizen.

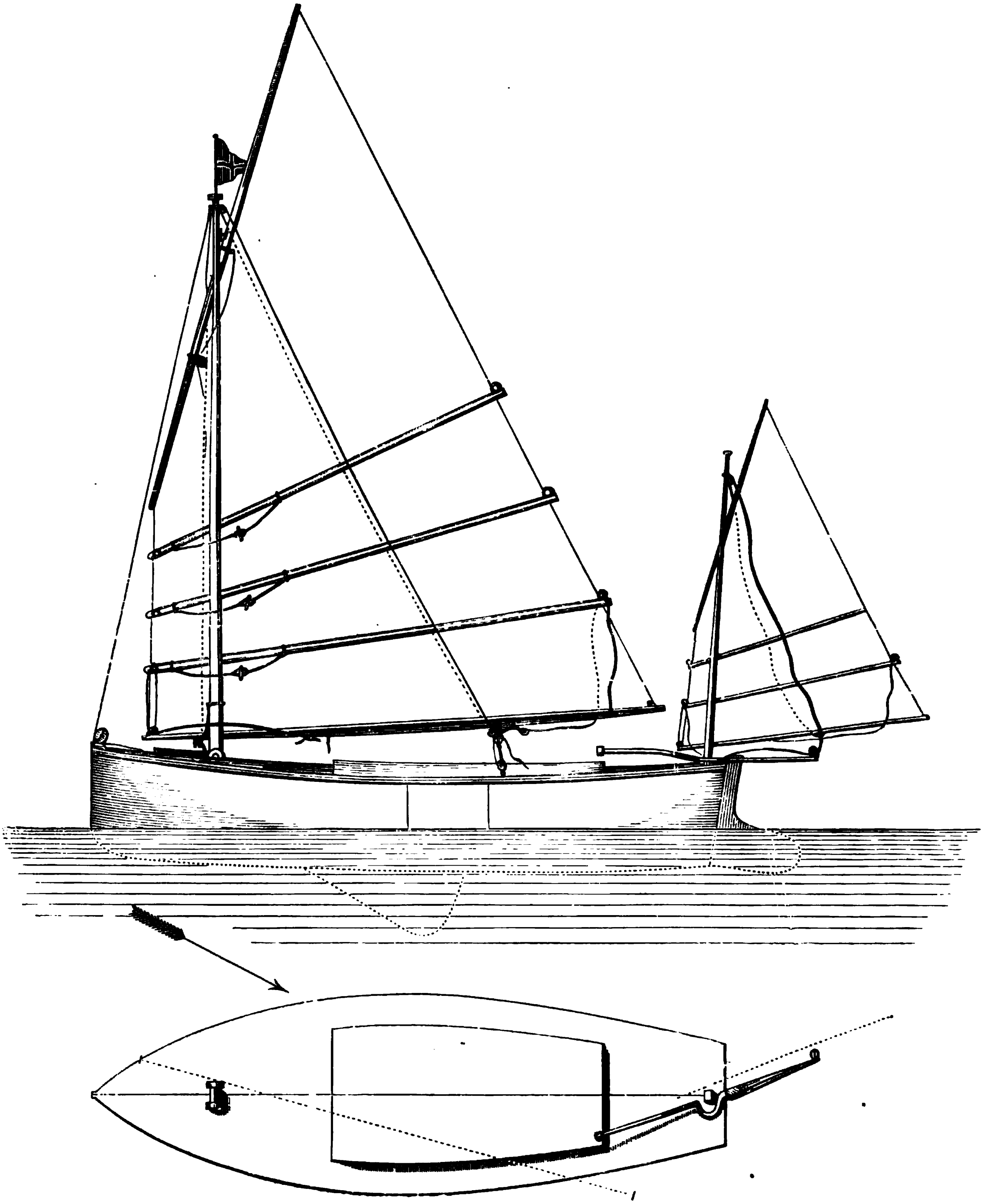
	ft.	in.		ft.	in.
Head	9	0	Luff	2	6
Leech	9	6	Tack to peak earing	10	6
Foot	6	6	Clew to weather earing	7	0

Areas.

	sq. ft.
Mainsail	119
Foresail	27
Mizen	38
Total	184

Area of reduced mainsail for single-hand sailing, 85 sq. ft. (4ft. 6in. to be taken off yard).

PLATE VI.



The dimensions of these sails will do equally well for the balance lug of the Surbiton type, as practically the only alteration to make would be in lacing the sail to the boom, and having the tack tackle fast to the boom instead of to the sail. The great round to the head will be an advantage, as it makes the sail square; and if the yard be a trifle longer, it is not carried quite so high.

The sail area shown in the drawing is a large one, but with three or four hands sitting to windward the boat would carry it well enough in moderate breezes and smooth water. For ordinary single-handed sailing it would be prudent to have a smaller mainsail, reduced as shown by the ticked line *a*; the sling would then come at *c*. The foresail should also be 2ft. shorter in hoist, and 6in. less on the foot; the mizen would be shortened 2ft. on the head.

The boat could be sailed with mainsail alone without shifting the mast, but she would probably be handier if the mast in such a case were shifted 1ft. farther forward. For turning her into the sloop rig, the mizen would be unshipped, the mainmast shifted 3ft. farther aft, and the foresail tacked to the stem instead of to the boomkin.

For a tyro who knows little or nothing of sailing, the 10ft. centre-board dinghy, rigged with a single balance lug, is a suitable craft for schooling, and, if he is fortunate enough to be located near a place where there is some shallow water, he may find out all about sailing without the assistance of a coach.

CHINESE LUG SAILS.

The Chinese plan of battening a sail has been very much recommended, and there is not much doubt that battens will keep a sail from going into a bag; the only objection to them of any importance is that they so much increase the weight of the sail. For a sail of the proportions given in the drawing (scale ¼in. to 1ft.), the battens should be 1in. thick, and 1⅜in. deep, tapering towards the ends (three battens, 1ft. 6in. distant at the luff of the sail, and 2ft. at the after leech). A reef band is sown on the sail to receive each batten, and the latter will be lashed at either end to leech and luff of the sail through thimbles; and, again, a thimble will be securely seized to each end of the battens, for the reef earings to be rove through.

The sketch shown on Plate VI. (scale ¼in. equal to 1ft.), made by Mr. W. Baden Powell, shews the arrangement of battens. Mr. Powell thus describes the gear and fitting of the sail:

"*Rig.*—Mainsail of the largest size the boat will carry in a steady moderate breeze, placed forward so that its centre of effort comes ahead of the centre of lateral resistance of the boat; mizen of the same cut as main, but of such size and so placed as to bring the centre of effort of the whole sail plan aft of the centre of lateral resistance (for a small boat should always carry weather helm; without it safety does not exist).

"*Fitting.*—The mainsail is fitted with a yard, a boom, and three or four battens; the sail is laced to yard and boom; the battens are lashed at their ends to luff and leech, and are, as it were, rove through a horizontal seam on the sail formed by sewing a 'reef band' across the sail to take the batten. The battens are made of pine, and taper at the ends like topsail yards. They are about 1⅜in. in diameter in the middle. The reef earings reeve through thimbles on the boom ends, and belay to 'patent' cleats on the boom.

"*Halyards*—Toggle on the single part to a becket or strop on the yard. The battens and the yard are kept in to mast by toggle and becket parrels.

"*Tack* is a single rope, leading from the well to a block on deck at side of mast; it then toggles to a becket on boom, about one-eighth the boom's length from fore-end. Both tack and halyards can be fitted with a purchase for setting up, according to size of the craft.

"The sail should be cut with very great 'peak' (yard as long as boom), so as to allow of a forestay, by which to lower the mast. The mast fitted on a 'tabernacle' * and pinned above deck, is a *sine quâ non,* whether the boat be used for river or sea work; bridges and tow ropes come against your mast in river work—ships' warps in harbours; and, when at anchor fishing, or tide waiting in a sea chuck-up, it is almost impossible to stand up forward and unship the mast, yet the great swaggering stick will not permit your little ship to ride easy.

"A topping lift is fitted, standing part fast to masthead, then down one side of sail, to reeve through sheet block strop thimble; then up on other side of sail to and through a block at masthead, and down to deck. Being through sheet block strop, which toggles on to boom, this topping lift remains with sheet on mast when sail is taken off and stowed away, and is thus ready for a change of sails.

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* A tabernacle is simply a perpendicular square trunk, or spout, as it is usually open on the aft side, made to take the lower part of the mast; if the mast is stepped on deck (as those of the river barges are) the heel of the mast will be pivoted on a bolt passing athwartships through the sides of the tabernacle above the deck as shown in Plate VI. Brass or iron plates should be fitted to the tabernacle where the bolt passes through, and there should be an iron band or ring on the heel of the mast. In an open boat the mast can be pivoted near the bottom of the tabernacle, thus: a bolt is fixed through the tabernacle (athwartships); on the heel of the mast is an iron band with two scores 1¼in. deep cut in it to fit the bolt; a score is also cut in the heel of the mast to correspond with those in the iron. The mast heel is fitted on the bolt by the score, and when on end is kept in its place by an iron or clamp on the thwart as usual. If the mast is pivoted on deck, it will be safer to have holes *through* the iron on the heel of the mast instead of mere scores for the bolt to pass through.

"A kind of gathering line, or sail keeper, is fitted to hold the sail up clear of the deck at the mast when it is lowered down, thus: one end fast at masthead, then down the side of sail on which the mast is not, and round under boom, and up, making it fast round the mast about 1ft. above the boom: thus, when going to set sail, you place forward end of boom, yard, and batten all in a bunch, between the mast and gathering lines, then the after ends through between the two parts of the topping lift; toggle the sheet, tack, and halyard on, and the sail is ready to set; the batten parrels can be toggled at any time afterwards, as they only effect a good 'sit' to the sail.

"The tiller should be formed as if double, *i.e.*, one part leading aft, and used as mizen boomkin, and the other on fore side of rudder with a U bend in it, to allow it to clear mizenmast. Thus fitted when working ship, on putting the helm down the mizen sheet is brought to wind, and main sheet is off, consequently shewould turn like a bicycle; or when the helm is put up, mizen sheet is thereby eased, and off she must go.

"A battened sail can easily be reefed 'in stays,' *i.e.*, while going about, without even checking the boat's way, for the battens do not require the reef points to be tied, except for neatness, unless it is a very deep reef.

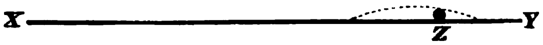
"A boat thus rigged can be hove-to in bad weather at sea, or, when waiting for tide into harbour, thus: take the mainsail off the mast, bunch yard and boom together, and span it with a rope; to the centre of the span fasten your boat's hawser, let the sail and battens hang loose, heave it overboard, and pay out the hawser; lower the mainmast, and haul mizen sheet fore and aft. Thus she will ride head to wind, and the sail will break much of the sea. The storm main lug may then be got ready, in case you have to cut and run."

Mr. Powell found, in canoe sailing that with battens he could carry much more sail (in the ratio 5 to 7) and the canoe would lie closer to wind. Also in running the canoe was much steadier, and did not roll so much as with the sail without battens. In gaff sails, where the peak halyards assist in keeping the sail flat, or in any sail that is well cut and can be kept flat, the advantage of battens will not be great. However, lug sails are very difficult if ill cut to keep flat, and battens in these may be found of service.

The regular "Chinese lug" was thus described by "Mercator," a writer in the *Field* in 1871.

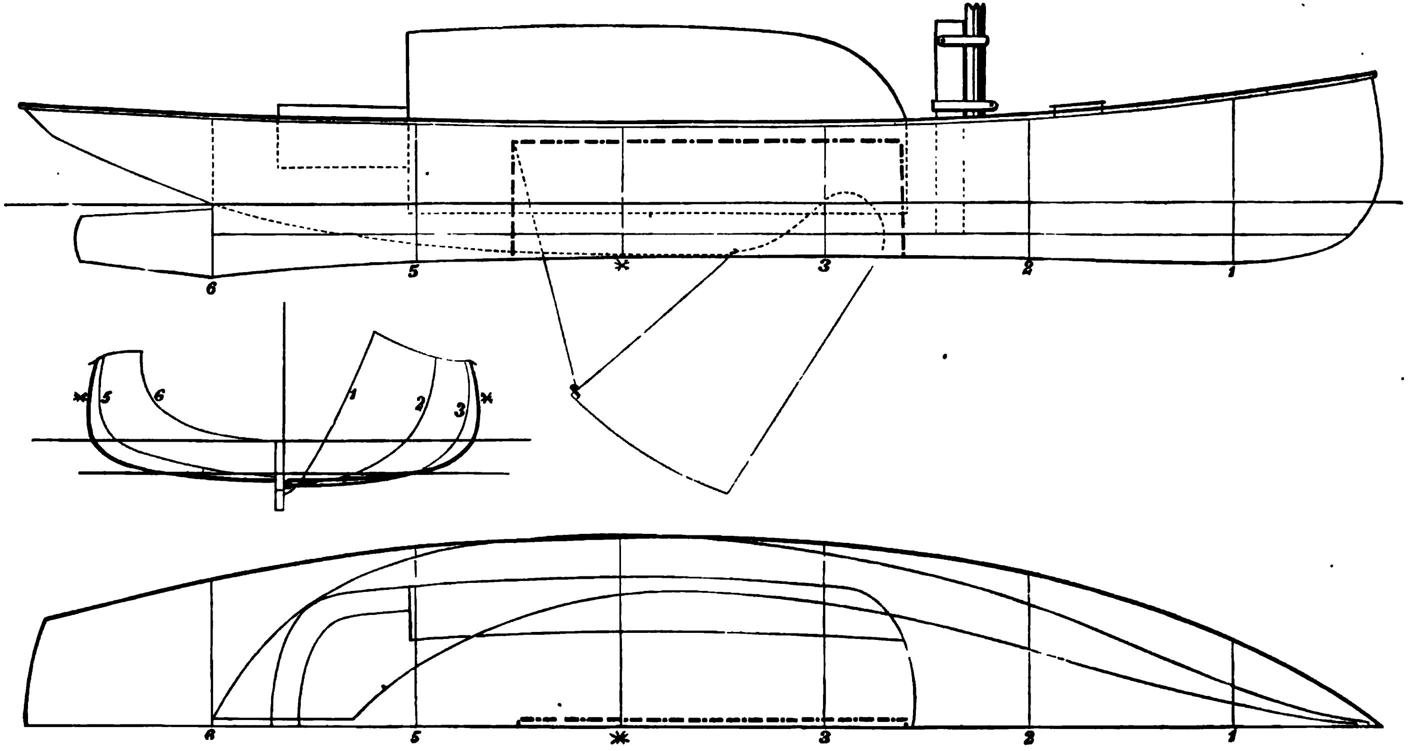
"Almost every district in China has a distinctive type of sail, some highly peaked, others with little or no peak, some with the leech greatly rounded at the peak, others with it cut almost or quite straight, some very narrow at the head and wide at the foot, others wide at the head and much the same width all the way down, some rigged on the starboard side, and others on the port side of the mast, some with sheets leading from all the battens, others with sheets from the lower ones only; in fact, the changes are rung in almost every conceivable way, but all, are provided with a brail, but which more resembles in its uses a topping-lift. As to the material of which the sails are made; matting is that most usually employed in native craft of any size, this article being extremely cheap in China, and when dry comparatively light; but for small boats, twenty to twenty-five feet gigs, and the like, a stoutish duck is the best, both for wear and look.

"The battens, it will be seen (see Fig. 46), are so arranged that the top and bottom ones do duty for yard (or gaff) and boom respectively, the intermediate ones radiating more or less sharply, according to the shape of the sail. The number for a gig would be five or six, to be increased with the size of the sail. To each batten is fastened a loop or parrel, if one may so call it, generally of rattan, but occasionally (in very small boats) of rope. The shape and position of these loops are indicated in the following sketch,



X Y being the batten, the dotted line the loop, and Z the position of the mast, looking down from above. From this it is apparent that these loops do duty as parrels; and the battens being made of bamboo, there is nothing to prevent the sail being easily hoisted and lowered, even when to windward of the mast. There is no tack proper, but the lower batten is made fast to the mast at the point where they intersect. The halyard (M) exactly resembles the simplest form used with lug sails, and is made fast to the forward portion of the upper batten, the exact place being regulated by the shape and sit of the sail. The luff projects 1ft. or 15in. (or even more, according to the size of the sail) forward of the mast. The sheets generally lead from several of the lower battens, one from each, and by a little mechanical arrangement are united into one sheet in such a way that the pull is everywhere equal. In some boats, where the sail projects some distance over the stern, two sets of sheets are required, one on each side. The sail when set is trimmed so that the lower batten is parallel to the keel. The brail or toppinglift is fitted in a very simple and efficient manner. A line leads from the masthead down the inside of the sail (*i.e*, the side on which the battens are), through an eye 1ft. or 2ft. from the after end of the lower batten, up again on the outside of the sail through another eye rove in the end of a short pendant from the masthead, and down again to the point where the lower batten and mast intersect, where it is made fast ready for use. The sail thus hangs in the bight of

PLATE VII.



" The Charm."

the brail as in a sling. The following sketch (Fig. 46) illustrates the sail described:

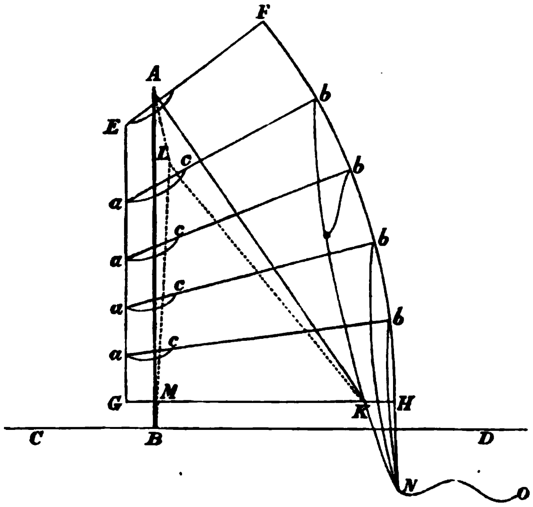


FIG. 46.

"AB, mast; EF, head of sail; EG, Luff of sail; *ab*, battens; CD, line of gunwale; GH, foot of sail; FH, leech of sail; *ac*, loops or parrels; AK, brail leading through eye at K, the position of the brail on starboard side of sail being shown by dotted lines KL, AL, and LM; the letters *b*N denote sheets hanging loose (over the sail instead of abaft it, as they would be when hauled in for sailing), leading into a single one, NO."

At Shanghae the completely battened lug sail is in much favour, and the description of yacht in use there will be found illustrated on Plate VII., which represents the Charm, Mr. C. J. Ashley.

It will be seen that the keel in form is crescent-shaped, or, in other words, the curve given to the keel tends upwards instead of downwards, as is usual in ordinary vessels. In the East this kind of keel is common, and we find it carried out to an enormous extent in the model of a Bombay yacht (the property of the Duke of Edinburgh) in the Naval Museum at South Kensington. The keel of this yacht is quite like a half-moon, but the draught forward is much greater than aft. There is no advantage in thus giving a vessel "gripe," as the centre of lateral resistance could be got forward without such an extraordinary and, when a small draught is necessary, inconvenient contrivance.

The Charm, it will be seen, is extremely shallow, and would take little ballast, as her weight of hull, spars, fittings, and stores would bring her down nearly to the load water-line. The floor timbers in the fore-body, it will be seen, are lower than those of the midship body, and abaft the midship section the timbers retain the flatness of the floor in the middle-body. One peculiarity of the after-body is, that the timbers are projected at right angles from the dead wood, and the gentle curve which we find in English yachts (made by filling up the angle in the runs) is not found in the Charm.

The length of the yacht is about three times her beam, and she thus has great stability; and this she needs, looking to the loftiness of her canvas. The chief excellence of the Chinese lug consists in the flatness of its surface. This flatness is brought about by battens, which are extended across the sail, as shown by 4 (Fig. 47) on the plan, and by the use of bow-line-bridles the whole way up the after leach of the sail. These bridles lead into two bowlines, and the bowlines again into one part, the latter leading to a double block on the bumpkin (8) extending from the taffrail, so that hauling on this single part brings an equal strain on each bowline-bridle. These bowline-bridles are numbered 7 in the drawing. To keep the sail into the mast a lacing (5 in the drawing) rove through parrels which extend from the luff of the sail to well into its belly; these parrels are distinguished by 6 on the sail plan. Beyond this, a hauling parrel is used to keep the yard into the mast, marked 12 on the drawing. The standing part is made fast to the yard, passing round the mast, then through a block on the yard, the hauling part leading to the deck. The topping-lift shown by No. 9 explains itself, the line denoted by figures 10 being the topping-lift on the port side. The topping-lift passes through a single block at the masthead.

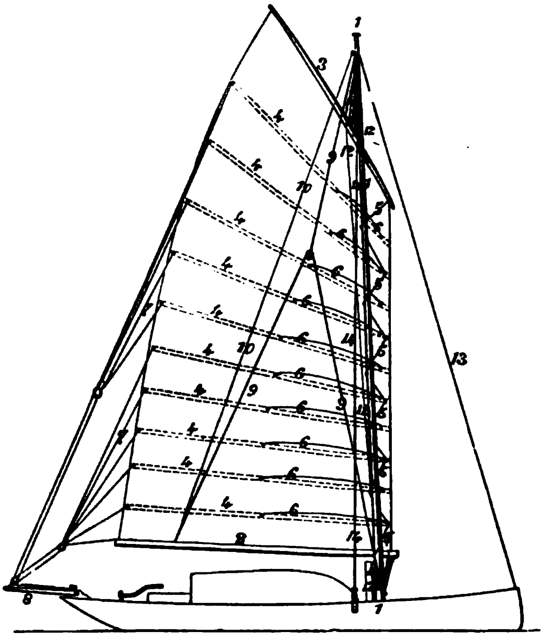


FIG. 47.

The other figures indicate as follows: 1, the mast; 2, the boom; 3, the yard; 11, main halyards; 13, forestay; 14, shroud. The mast can be unshipped at pleasure, as the drawing shows; and, as there is neither bowsprit nor topmast, such a vessel could be dismantled in a very few minutes. The Charm has a booby hatch, and under this there is a great deal of room. The centre-board is shown in the sheer plan lowered to its full depth, and the lines — . — show its case. When hauled quite up, the board would protrude above this case; but this need never be done, as the draught could not thereby be made less than it is at all times aft. The dotted lines above the keel aft show the intersection of the timbers with the dead wood; the dotted lines in the middle-body show the plan of the cabin, and the cockpit forming the entrance to the cabin.

The following table refers to Plate VII., representing the yacht Charm:

No. of Sections.	Half-breadth at Load Water Line.	No. of Sections.	Half-breadth No. 2 Water Line.	No. of Sections.	Height from Load Water Line to Plank Sheer.	No. of Sections.	Depth from Load Water Line to under-side of keel.
	ft. in.		ft. in.		ft. in.		ft. in.
1	1 2	1	0 8½	1	3 4½	1	1 8
2	3 10½	2	2 4	2	2 8	2	1 8
3	5 6	3	4 0	3	2 5	3	1 7
4	6 1½	4	4 2	4	2 5	4	1 7
5	5 4	5	1 9½		2 6½	5	1 9
				6	2 9	6	2 2

Distance the sections are apart, 6ft. 6in.
Distance No. 1 section is from fore side of stem at L.W.L., 4ft. 6in.
Distance water lines are apart, 1ft.
Length on L.W.L., 37ft.
Beam on L.W.L., 12ft. 3in.
Beam, extreme, 12ft. 5in.
Displacement, 9·26 tons.
Centre of displacement below L.W.L., 0·736ft.

Metacentre above centre of displacement, 8·2ft.
Area of sail, 990 sq. ft.
Luff of sail, 35ft.
Leach of sail, 54ft.
Foot of sail, 26ft.
Head of sail, 21ft.
Tonnage by R.T.Y.C. rule, 20·3 tons.
Area of L.W.L., 295 sq. ft.
Displacement for 1in. of immersion at L.W.L., 0·7 ton.

SPRIT SAILS.

Sprit sails formerly were in high favour, but during the last twenty years they have gradually fallen into disuse. It is still a favourite rig, however, among watermen, and they probably adhere to it because the sprit stretches the sail so flat. The old Ryde wherries, celebrated for their fine weatherly qualities, were sprit-rigged, but of late years they have generally adopted the gaff instead of the sprit. The advantages of the sprit over a gaff for setting a sail in a small boat cannot be denied, as by crossing the sail diagonally it takes up all the slack canvas in the middle of the sail, even if it be an old sail. On the other hand, a sprit is an awkward spar to handle, and it need be much longer and heavier than a gaff to set similar sails.

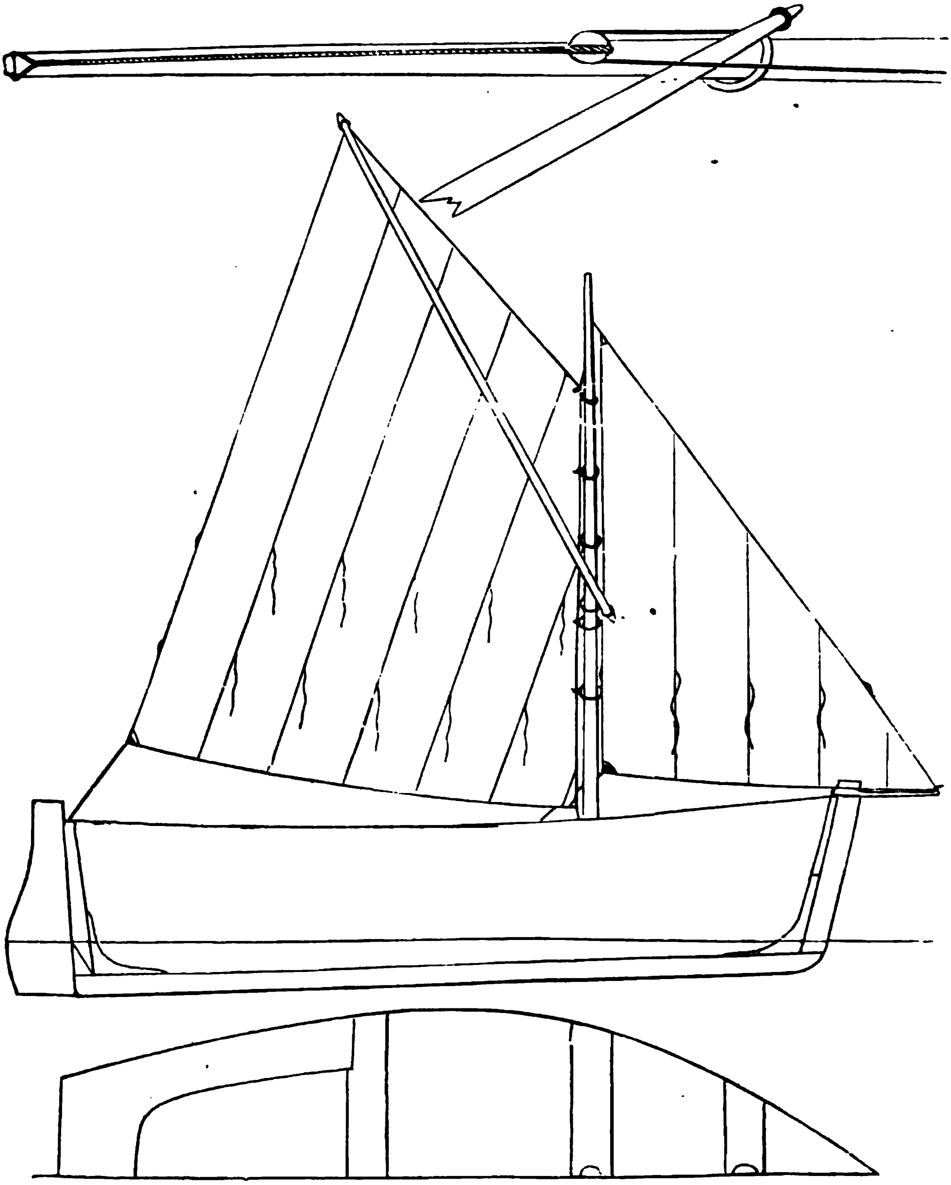


FIG. 48.

In small boats the luff of the sail is usually laced to the mast through eyelet holes about 2ft. apart; the throat is secured to an iron traveller, or sometimes to a grommet strop. In large sails galvanised iron rings or mast hoops are used. The tack is lashed to a small eyebolt screwed into the mast. The sail is hoisted by a single halyard and belayed to the gunwale to serve as a shroud. The foresail is also belayed by a single halyard, and belayed to the opposite gunwale. The sprit is supported on the mast by a strop called a snotter; this strop is a piece of rope with an eye spliced in each end; it is put round the mast, and one end rove through an eye; the heel of the sprit is put in the other eye. After the sail is hauled up on the mast the upper end of the sprit is put into the eye or loop on the peak of the sail, and then shoved up and the heel shipped into the snotter. The sail is then peaked by pushing the snotter and heel of sprit as high as required; the sail is then sheeted. If the sail is large and the sprit heavy, a traveller and whip purchase are used. See Fig. 48.

A pendant with an eye spliced in it is fitted over the masthead; at the lower end of this pendant is a block, through which the hauling part is rove, one end being fast to the thwart. Sometimes a gun-tackle purchase is used instead of the whip purchase. Either is to be preferred to the snotter alone, as without any other support the snotter will be continually slipping down. If there should be much wind when the snotter slipped down the mast the heel of the sprit might go through the bottom of the boat; and this accident has very often happened. The waterman's remedy for this is wetting the mast, but the single whip purchase is to be infinitely preferred, as it not only keeps the sprit from slipping down, but enables the sail to be set better.

THE SLIDING GUNTER.

The sliding gunter, it has been claimed, has all the advantages of the lug sail; has lighter spars compared with sail area, and is less dangerous. This may be true enough of the old-fashioned dipping lug, which no doubt is a dangerous sail, but we very much question if the gunter will ever be able to compete with the balance lug, in weight of spars or in handiness, effectiveness, or safety.

The mast, it will be seen by Fig. 49, is in two pieces, the upper part sliding on the lower by two irons. When hoisted the lower part of the luff of the sail is laced to the mast. The irons should be of brass or of galvanised iron, covered with leather, and they should be kept well soaped or greased. The irons are fitted to the upper part of the mast (usually termed the yard), and should fit the lower part very loosely, as a common peculiarity of the iron is to jam either in hoisting or lowering—mostly during the latter operation—especially if the boat be heeled. The yard is hoisted by a single halyard rove through a sheeve-hole at the lower masthead. The halyard is fast to the heel of the yard, and a score is cut out for it on the fore-side of the yard; it leaves the yard at the upper iron. The gunter rig is sometimes applied to long boats with three masts, a stay foresail being invariably used. The sketch given shows a sail fit for a 17ft. boat (such as Plate III.), and has foresail and Mudian mizen.

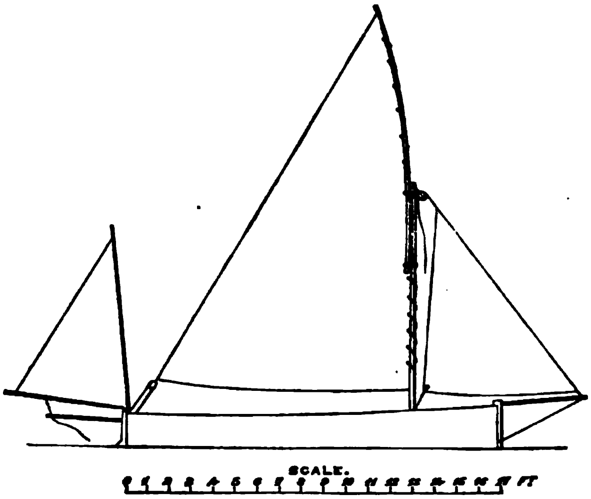


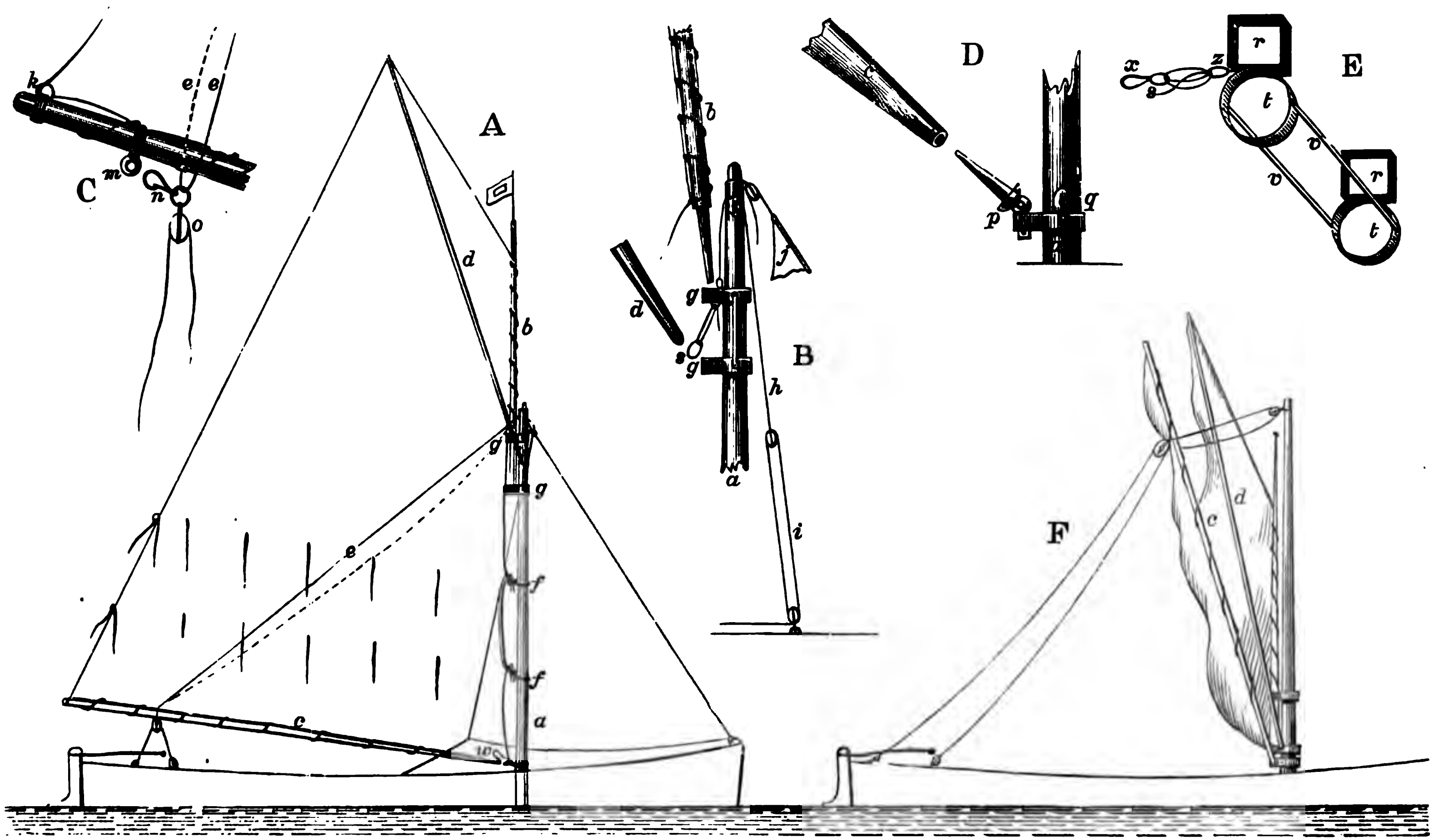
FIG. 49.

GUNTER SPRIT RIG.

Some years ago Mr. Baden-Powell brought out a rig which was a combination of the gunter and sprit. He first fitted it to canoes, and afterwards to a centre-board gig. The objects sought were a lofty sail, with a mast readily shortened for going under bridges, &c.; reduction of top hamper or weight when reefed down; and mast and spars of such length as could be stowed inside the boat. The rig was intended entirely for cruising, and not meant to compete against the balance lug for racing. The following diagrams (Plate VIII.), on a ¼ inch scale, will show the rig:

A shows the sail set.
a is the mast.
b, the topmast.
c, the boom.
d, the sprit.
e, topping lift; the ticked line shows the topping lift to leeward.
f, mast hoops.
g, gunter irons.
w, a hook on the goose neck to hook to the reef cringles when the sail is reefed.
B is a view of the mast head.
a is the mast.
b is the topmast unshipped from the gunter irons *g*.
d is the sprit unshipped from the snotter *s*.
h is the standing part of the halyard passing through the sheave at the mast head, and fast to an eye on the upper gunter.
i is the purchase for the halyard, the standing part fast to the lower block.
j is the head of the jib.
C is a view of the boom end.
k is the clew of the sail lashed to boom.
m is a grommet strop with thimble eye.

PLATE VIII.



Gunter Sprit Rig.

n is a clip or spring hook on swivel ready to be hooked into the eye *m*.
o is the mainsheet block.
e is the topping lift.
D is a view of the boom and gooseneck.
p is the gooseneck on the mast *a*.
c is the boom ready to be shipped on gooseneck.
q is a block for the fall or hauling part of the main halyards. (This block can be on the mast thwart or deck; see B.)
E is a bird's-eye view of the gunter iron.
r is the square part into which the topmast is stepped.
t is the ring traveller shipped on the mast.
v two iron stays or connecting rods which hold the gunters together.
s is the snotter loosely laced.
w is an eye splice to take the sprit, with a thimble seized in at *s*.
x is another thimble with a tail lashed to the gunter. A rope or lanyard is spliced to the thimble *s*, and rove through and through the thimbles *s* and *x*, so that the snotter can be made of a length to suit the length of the sprit.
F is a view of the sail brailed up by the topping lift, and with topmast housed.

The sail is laced to both boom and topmast, and *tied* to the mast hoops. To stow the sail, lower away by the halyards (which are fast to the upper gunter iron); unship the sheet block from the boom; unship the sprit; unship the topmast from the gunter; unship the boom from the gooseneck; untie the sail from the mast hoops; roll up, and stow away. The mast can be unstepped or not at pleasure.

In large 16ft. craft it was found necessary to have a fore stay.

A down-haul should be bent to the gunter iron.

To reef, lower the topmast (the sprit of course comes down with it) by the halyard to first or second reef band; lay the foot of the sail neatly in folds along the boom, and tie round the boom with the reef nettles or points.

FALMOUTH LUGGERS.

The following excellent description of the Falmouth luggers was written by Mr. Wilcocks in the spring of 1869 for the *Field* :—

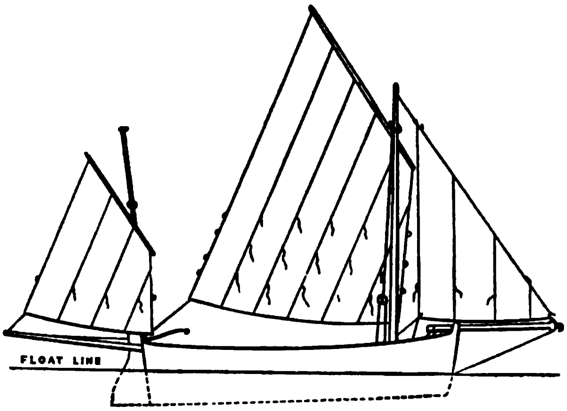


FIG. 50.

"The mizen-mast is shown after the manner of the Mount's Bay craft, much more taunt than is necessary for setting the ordinary mizen, so that the second foresail may be set in its place in light weather. The only different arrangement required would be a longer outrigger, and a mast-hoop or traveller on it, to accommodate the set of the ordinary mizen. The bowsprit should be somewhat longer than here represented (Fig. 50) to get the jib a little further out. If the mast were stepped at the position shown by the heel of the bowsprit, the rig would be like the Falmouth boats, and it is a good plan to have such a boat fitted also in this manner. The omission of a jib in the Falmouth boats is for the convenience of dispensing with a bowsprit whilst running alongside shipping. Fig. 51 is a sketch of the Falmouth waterman's rig. It is in use for boats from 14ft. long up to substantial little craft, apparently of as much as 7 or 8 tons. From the mast being so far forward, we might imagine a boat thus rigged would pitch heavily in a head sea, and I cannot altogether divest myself of this impression; therefore, should prefer to have two places for stepping the mast, with a moderate-sized jib to balance the after canvas, when the mast is in its after position. Boats intended to carry their masts so very far forward should be built with additional free-board forward to allow for plunging if caught in troubled water. This is well attended to in the Guernsey fishing boats, which are built very high forward, and answer well. In a large boat it is a good plan to have a horse of galvanised iron across the stern for the main sheet, with a single and double block, the double block grommeted to a thimble traversing on the horse. There will then be no sheet to tend in going about when under the mizen and lug foresail, the only thing required being possibly a touch to the double block, to get it well down to the extremity of the horse. In making the horse,

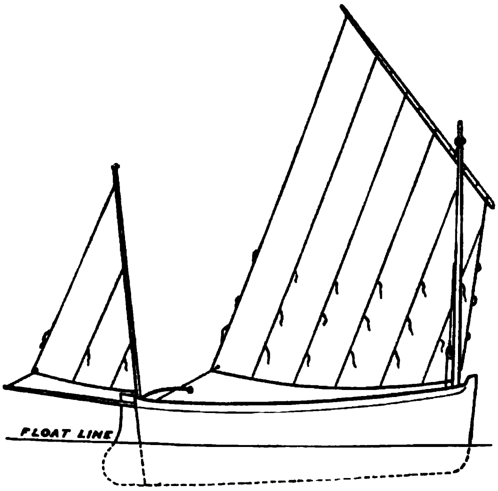


Fig. 51.

the smith must not forget to weld on a collar to either end, that the traversing thimble may not slip round the turns of the horse at the sides of the boat. In small boats, up to 18ft. in length, a single sheet made fast to a belaying pin through the transom board, is the safer plan, unless the boat be a deep-bodied craft, especially built for sailing. It is often desirable to shorten sail by tricing up the tack in all kinds of sailing craft. For this a tackle must be provided to keep a strain on the luff of the sail, as the peak would otherwise immediately fall on letting go the tack. The upper block should have a pair of sister hooks, which can easily be attached to the second cringle of the sail, and by aid of a small block secured close to the slings of the yard, the tack can be triced up when required. It is an unusual thing to trice up the tack of a lugsail; nevertheless, in anything but a small boat, the handiness is unquestionable, and, in fact, in a boat fitted with one large lugsail, it is often necessary to do so."

LOWESTOFT LATEEN SAIL.

The lateen rig has not been much adopted in the English coast, owing probably to the length and weight of the yard required, and the awkwardness of the reefing arrangements. Sometimes the sail is reefed along the foot, as shown in the engraving of a Lowestoft lateen (see Fig. 52), and sometimes along both foot and head. In the sketch given, the sail is shown with very great peak, but the sails are sometimes planned with the

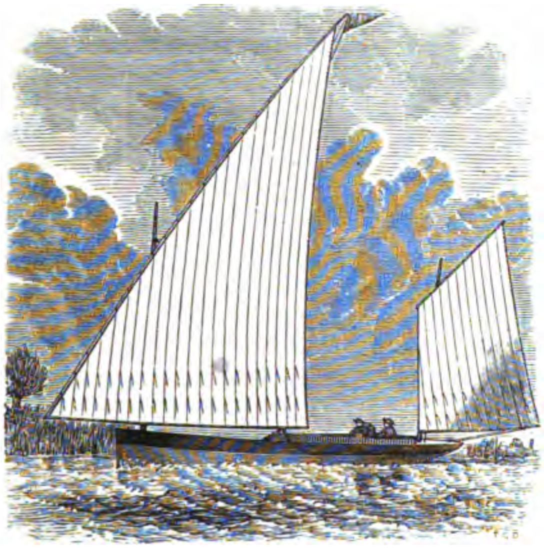


Fig. 52.

yard more across the mast, and with a longer boom. A lug mizen is generally a part of the rig. The boom is kept to the mast by an iron traveller or ring.

The settee sail is an adaptation of the lateen; the yard does not reach quite down to the tack, so that a short up-and-down luff is obtained to the extent of two or three reefs as shown in Plate V.

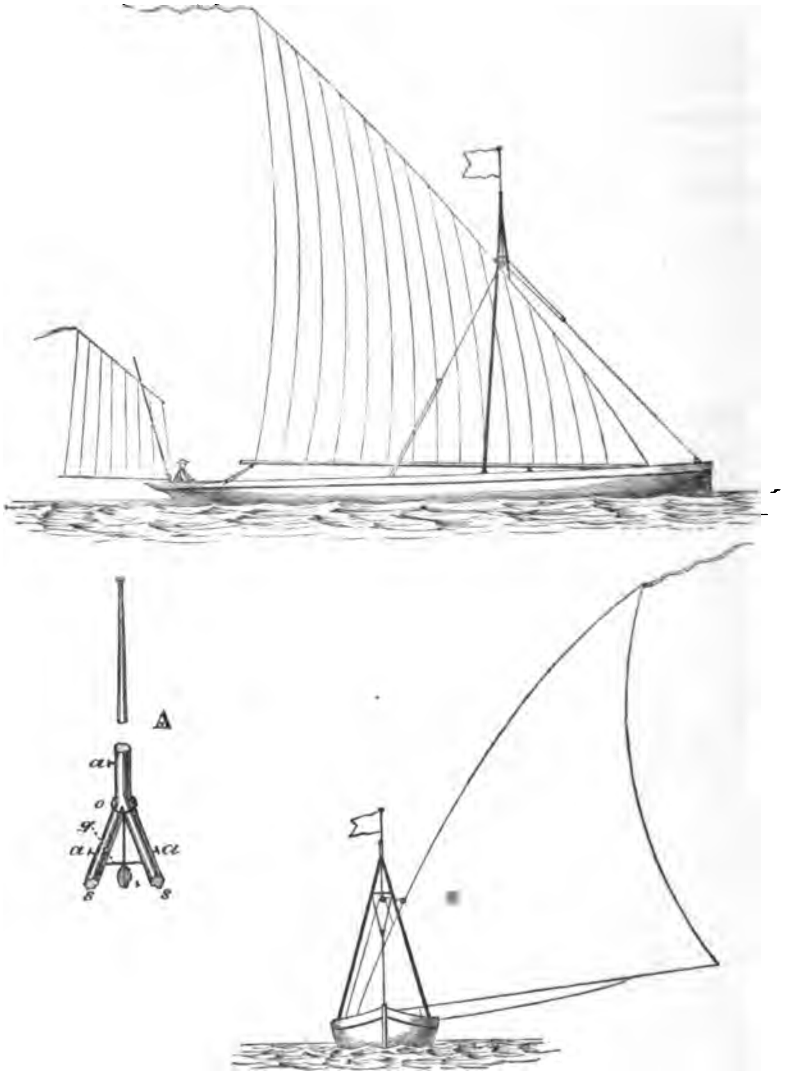


Fig. 53.

ALGOA BAY LATEEN.

The lateen rig is met with all over the world, and is much in use on parts of the African coast. In Algoa Bay, Cape of Good Hope, a curious contrivance for hoisting the sail on sheer masts instead of on a single mast has been adopted; the plan is common to the prahus of the Eastern seas, and to the river rafts of the Mayaquil rivers. Mr. William Fleming, of Port Elizabeth, Algoa Bay, had a boat fitted in this way as shown by the accompanying sketch drawn by him (Fig. 53); the rig is thus described:

In lieu of the usual way of fitting and stepping a mast, two short poles are fixed triangle fashion, and secured to each side of the boat with a goose-neck, so as to move fore and aft. The heads of the poles fit into sockets, *s s.* (diagram A), which can be made either of iron (galvanised) or of gun metal; a transverse bar, *g*, keeps the sockets from opening at the throat. The sockets must be made deep, to fit the spars well in, and a small bolt, *a a a*, running right through for further security. The upper socket will hold a flag pole. The forestay will be fast to each mast by a bridle, and the runner and pendants will on either side be fast to a mast. A double block with tail is made fast round the neck of the sockets at *o* (A), for the halyards to work through. The standing part of the halyards is fast on the yard, then leads through the block under the throat of the socket, through a block on the yard, and back through the double block. The advantage of the two mast plan is obvious—no dipping of a lug when going about, and affording scope for any variety of cut sail, peculiarly adapted for lateen rig. Masts and sails can be lowered by the run by just slacking up the forestay, and hauling on it again when required to make sail, without starting halyard, sheet, or tack. The tack of the sail may be fitted to travel on a horse, and kept in any position by a rope rove through a single block, one to be fitted on each side. Wire rope should be used for forestay and the pendants. The plan now suggested has this advantage, that everything can be lowered at a moment's warning, masts and sails snugly stowed in the boat, and if necessary to use oars, no masts stand in the way to prevent doing so effectually.

CHAPTER XIV.

BRIGHTON BEACH BOATS.

The Brighton beach boats enjoy a very high repute on the South Coast, and no doubt they are very capable little vessels, and well adapted for the work they are put to. As there is no sheltered anchorage at Brighton, the boats are hauled up on the beach; and a more or less flat floor is necessary for this operation, in order that the boats may be floated as far up on the beach as possible. The boats are fitted with stout bilge keels three or four inches deep, on one of which a boat rests as she is hauled up. Ways are now laid down for hauling the boats up and launching them off; but a few years ago the boats were hauled over the beach by a capstan, without ways. The latest boats are built with much more rise of floor than formerly, and they are found to be all the better for it.

There are many advantages justly claimed for the Brighton beach boats, and especially for those of the Black Joke type, whose lines are given in "Yacht Designing;" they can be run over a sandbank in a foot or two of water to the "smooth on the other side;" whilst the deep boat, of equal length perhaps, must remain pile driving outside in the lop. They can be allowed to take the ground without any fear of their not getting upright again; and, if necessary, they can be run ashore to effect a landing. These certainly are advantages which cannot be claimed for a 5-tonner of the modern school, and it is not surprising that for coast work the beach boat is in such very high favour.

Mr. Thomas Stow, of Shoreham, has built many successful beach boats, and the lines which we now publish (Plate IX.) are taken from a model he made as an example of his latest ideas as to what a beach boat should be like. The "fairing" process required the design, as taken from the model, to be modified a little, and the midship section* is a trifle farther aft than

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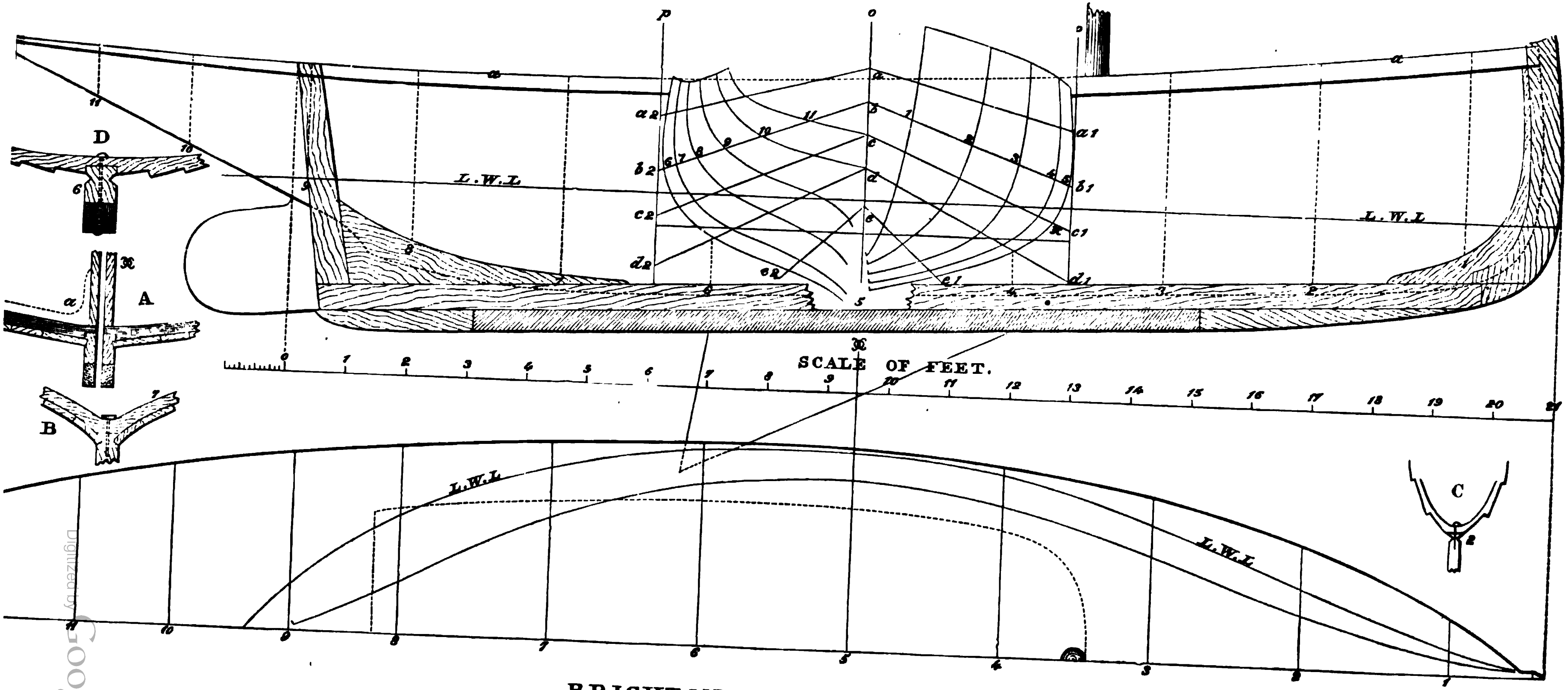
* The practice in building the Brighton beach boats is to place the midship section at about the mid-length of the boat, and rake it forward a little. Probably better results would be obtained by having the mid-section in the position we have placed it, and, as the after body appears to be all that could be desired as to form and length, there is no object in raking the mid-section forward.

PLATE IX.



BRIGHTON BEACH BOAT.

it was in the model; but no important departure has been taken from the original lines as first taken off. It will be seen that some portion of the counter is immersed, and we believe that this is admissible under the rules of the Brighton Sailing Club, whose present rule of measurement takes length from stem to sternpost. The design has a trifle more displacement than the generality of the boats; but this is by no means a fault, and the boat will be all the better for it.

The rig common to all, we believe, is that known as the cutter, and the boats require a very great deal of head sail; but, as the design given (Plate IX.) has a finer entrance than is usual, the probability is that such a boat would require less head sail than the ordinary run of beach boats, and would consequently be less hard on her helm.

The boats are decked-in up to the mast, and the counter is also decked, whilst a water-way is built round the midship sides of the boat about 1ft. wide, with 3in. coamings. The centre plates were formerly much larger than that shown in the design; but, with so much keel under the boat, very little plate is necessary, and, indeed, the boat would hang very well to windward without any plate down at all.

The general floor construction of the boats is shown by Fig. D, representing a floor section at No. 6. The floor is joggled to the keel as shown, and shaped to the mould at each section; the floor is then taken out and joggled and bevelled to receive the plank, as the boats are generally clench built. Where they are carvel built the construction is shown by Fig. A, representing the midship section, with heels of floor cut through to admit the centre plate. The construction at No. 7 station is shown by Fig. B, where considerable depth has to be given to the throat of the floor. Sometimes the floors aft and forward are steamed and bent into their stations, being afterwards removed to be joggled (as shown by Fig. C, representing No. 2 station forward) if the boat is clench built.

The centre-board case is generally of wood with a knee, as shown by *a*, Fig. A, to keep it in its place, and to generally strengthen the floor of the boat.

Greatest length from fore side of stem plumb at L.W.L. to aft side of stern post on deck	**21ft.**
Greatest beam moulded	**6ft. 10½in.**
Greatest beam extreme	**7ft.**
Weight of hull (exclusive of iron plate, iron keel, and ballast, spars, sails, and crew	**14cwt.**
Iron keel	**4cwt.**
Centre plate	**1½cwt.**
Ballast inside	**5½cwt.**
Spars, sails, and gear	**7cwt.**
Crew	**8cwt.**
Total weight of displacement to L.W.L.	**2tons.**

Moulding (depth) of wood keel from top to under side, 5in.
Siding (breadth) of wood keel 4in. amidships, tapering to 2½in. forward and 3in. aft.
Siding of stern post, 3in.
Siding of stem, 2½in.
Siding of floors, 1¾in.
Siding of timbers, 1½in.
Distance floors are apart from centre to centre, 10in.
Thickness of plank, ⅝in. (Clench work.)
Length of iron keel, 12ft.; depth, 4in., tapered in breadth fore and aft to shape of wood keel.

SPARS.	ft.	in.
Mast, deck to hounds	19	0
Boom, extreme	20	0
Gaff, extreme	16	0
Topmast, heel to hounds	16	0
Topsail yard	18	0
Bowsprit, outside stem	16	0
Mast is stepped 8ft. from the fore side of stem.		
Luff of mainsail	16	0
Head of mainsail	15	6
Foot of mainsail	19	3
Leech of mainsail	28	0
Tack to peak earing	30	3
Clew to throat	24	9
Foot of foresail	8	0
Luff of foresail	18	0
Leech of foresail	17	0
Foot of jib	16	0
Luff of jib	26	0
Leech of jib	16	0
Luff of jib topsail	24	0
Foot of jib topsail	12	0
Leech of jib topsail	15	0

LAYING-OFF TABLES.

Sections.	1	2	3	4	5	6	7	8	9	10	11
SHEER PLAN.	ft. in.	ft. in	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to deck*	2 9½	2 6	2 3½	2 1½	2 0	1 10½	1 9	1 9½	1 10	1 11	2 0
Depths to upper edge of rabbet	—	1 2†	1 3¾	1 4½	1 5	1 6	1 7†	1 8†	—	—	—
Depths to top of wood keel	—	1 0	—	—	—	—	—	1 7½	—	—	—
HALF-BREADTH PLAN.											
Half-breadths on deck	0 10	1 11½	2 8	3 1	3 4	3 3½	3 2	3 0	2 10	2 7	2 3¼
Half-breadths on L.W.L.	0 5	1 3¾	2 3	3 0	3 3	3 2¼	2 9½	1 11	0 9	—	—
BODY PLAN.											
Diagonal *a*	0 9¾	1 11	2 8¾	3 3¼	3 5¾	3 5¼	3 3½	3 1¼	2 10	2 5	2 0½
Diagonal *b*	0 9¾	1 10	2 8¼	3 4	3 6¾	3 6	3 3½	2 11½	2 5¼	1 10	1 0
Diagonal *c*	0 8½	1 8	2 6	3 1½	3 4¾	3 3½	3 0	2 5½	1 9¾	1 0½	—
Diagonal *d*	0 6½	1 5	2 1½	2 7½	2 9¾	2 8	2 4	1 8½	1 0	—	—
Diagonal *e*	0 4¾	0 11½	1 3½	1 6½	1 7½	1 7	1 4	0 10	0 3	—	—

* The deck is flush with gunwale.

† The heels of the floors at Nos. 2, 7, and 8 stations are not joggled as those at Nos. 6, 5, 4, and 3 are (*see* diagram B). The ticked line in the drawing represents the lower edge of the rabbet 2¾in. from the top of keel.

No. 1 station is 1ft. 6in. from the fore side of the stem. Nos. 1, 2, 3, 4, 5, 6, 7, and 8 stations are 2ft. 6in. apart. No. 9 station is 1ft. 9in. from No. 8. No. 10 is 2ft. from No. 9. No. 11 is 1ft. 6in. from No. 10.

a diagonal is struck on the middle vertical line *o* (*see* body plan) 2ft. 2in. above the load water-line; it cuts the side perpendiculars *pp* at *a* 1 and *a* 2 at 1ft. 3in. above the load water-line.

b diagonal cuts *o* 1ft. 8in. above L.W.L.; cuts *p* 4in. above L.W.L.

c diagonal cuts *o* 1ft. 1½in. above L.W.L.; cuts *p* 4in. *below* L.W.L.

d diagonal cuts *o* 6½in. above L.W.L.; cuts *p* 1ft. 1½in. *below* L.W.L.

e diagonal cuts *o* 1in. *below* L.W.L.; and at *a* 1 and *a* 2 is 1ft. 3in. below L.W.L., and 1ft. 4½in. out from *o*.

All the half-breadths given are *without* the plank.

CENTRE-BOARD BOAT

SCALE ½ IN = 1 FT.

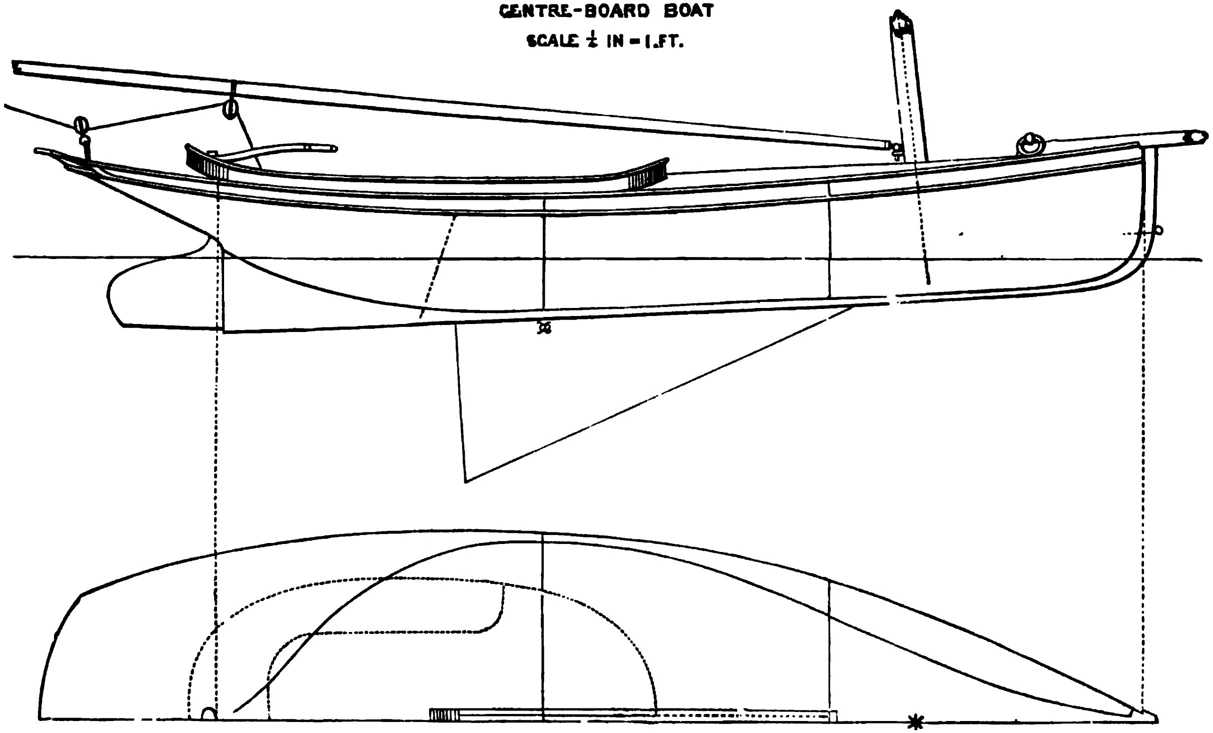


Fig. 54.

CHAPTER XV.

CENTRE-BOARD SLOOP.

A DESIGN for a centre-board boat, somewhat shallower than the Brighton Beach boats, and one admirably adapted for smooth water sailing, was published in the *Field* of April, 1871, by a gentleman under the *nom de plume* of "Seagull."

The design is shown on Fig. 54, and the only alteration made in it is the shape and manner of pivoting the centre-board or plate. The body-plan has been re-drawn, and a sufficient number of sections added thereto, to make it more useful to the builder. It will be seen that the mid-section is very much further aft than in any of the other centre-board boats of which lines are given, and in this respect the design more agrees with the American model. The bow is long and very shapely, and no doubt a boat built on the lines would be fast.

Length stem to sternpost on deck	**20ft.**
Breadth, extreme, with plank on	**8ft.**
Weight of displacement to L.W.L. (about)	**1·6 ton.**
Weight of ballast	**8 cwt.**
Mast, deck to hounds	**20ft.**
Hounds to topsail sheave	**6ft.**
Main boom	**22ft.**
Main gaff	**12ft.**
Bowsprit outside	**6ft.**
Siding of stem	**2½in.**
Siding of sternpost	**3in.**
Siding of keel amidships	**4in.**
Siding of keel fore end	**2½in.**
Siding of keel aft end	**8in.**
Thickness of plank	**¾in.**

In the body plan, Fig. 55, more sections are shown than there are stations in the sheer plan; in the sheer plan every other station has been omitted.

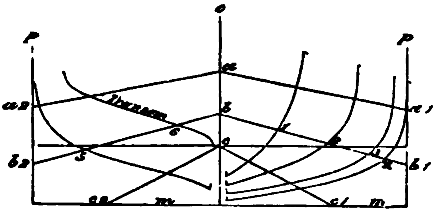


FIG. 55.

LAYING OFF TABLE.

	1	2	3	4	5	6
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to deck edge	2 0	1 8½	1 5¾	1 4¾	1 4¾	1 8
Depths to rabbet line of keel	0 8	0 9½	0 11½	1 1½	0 10½	—
Half-breadths on deck	1 9¾	3 0	3 8	3 11½	3 10¼	3 4½
Half-breadths on L.W.L.	1 1	2 4	3 5	3 9	2 11	0 1
Half-breadths on diagonal *a*	1 8¼	3 0	3 9½	4 0	3 10½	2 10
Half-breadths on diagonal *b*	1 4	2 5½	3 8¾	3 7½	2 10¼	0 9¾
Half-breadths on diagonal *c*	0 8½	1 2¼	1 8	1 10¼	1 2¼	0 1

All the half-breadths are without the plank.

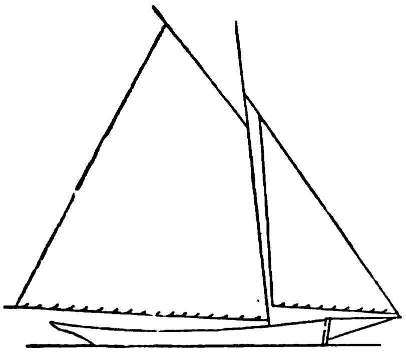
No. 1 section is 4ft. from the extreme fore side of stem.
No. 2 section is 3ft. from No. 1.
No. 3 section is 3ft. from No. 2.
No. 4 section is 3ft. from No. 3.
No. 5 section is 3ft. 6in. from No. 4.
No. 6 section is 3ft. 6in. from No. 5.

Diagonal *a* is struck on the vertical line *o* (Body Plan) 1ft. 6½in. above the L.W.L., and cuts the perpendiculars *p p* 9½in. above the L.W.L. at *a* 1 and *a* 2.

Diagonal *b* is struck on the line *o* 8in. above the L.W.L., and cuts *p p* 4in. below L.W.L. at *b* 1 and *b* 2.

Diagonal *c* is struck on *o* at its intersection with the L.W.L., and cuts the horizontal line *m* at *c* 1 and *c* 2.

The rig it will be seen by Fig. 56 is the ordinary sloop. The mainsheet is thus worked; one end fast to the boom end; the other leads through a block on the counter, then through another block on the boom, and belays inside the boat close to rudder head or on one side of the rudder head.



SCALE 1/16 IN = 1 FT.

FIG. 56.

CHAPTER XVI.

UNA BOATS.

THOSE wonderful little crafts called "Una" boats, were introduced to us in 1853, in this way: the late Marquis of Conyngham (then Earl Mount-Charles), was in America in 1852, and in the boat building yard of Robert Fish, (now well known as a yacht designer) saw the boat since celebrated as the "Una." He sent her to London by steamer, whence she was transported by rail to Southampton, and then towed to Cowes. The Una, we believe, spent a summer on the Serpentine, but she did not there excite the interest she did at "head quarters." In fact, the Cowes people almost regarded the Una as a little too marvellous to be real. To see the Una dodging about on a wind and off a wind, round the stern of this craft, across the bows of that one, and generally weaving about between boats where there did not look room enough for an eel to wriggle, was a sight for the shore people, who had never seen anything more handy under canvas than a waterman's skiff with three sails, or an Itchen boat with two. In short the Una with her one sail worked like a steam launch, and no wonder in less than a year there was a whole fleet of Unas at Cowes, and about the Solent. The genus was named Una after Lord Conyngham's importation, and to this day no class of boat is a greater favourite. Lord Conyngham's sailing master John Hollis, was very perfect in the management of the Una, and waltzed her about as cleverly as a Rhode Island fisherman in many sailing matches; indeed, Lord Conyngham was so pleased with his success, that he presented the clever timoneer with a silver snuff box, bearing a figure of the Una in relief on the lid.

In America, the "cat-rig" as it is termed, is a great favourite, and at Newport, where the rig is mostly seen, the boats enjoy a great reputation for handiness, weatherliness and speed. There is no doubt, that the one sail plan is the best for weatherly qualities, and for handiness, if there be no sea, and if it is all turning to windward. In a sea, however, the heavy mast, stepped so far forward, makes the boats plunge dangerously, and the boats themselves are so shallow that they are not very well adapted for smashing through a head sea. Then off a wind they are extremely wild, and show a very great tendency to broach to.

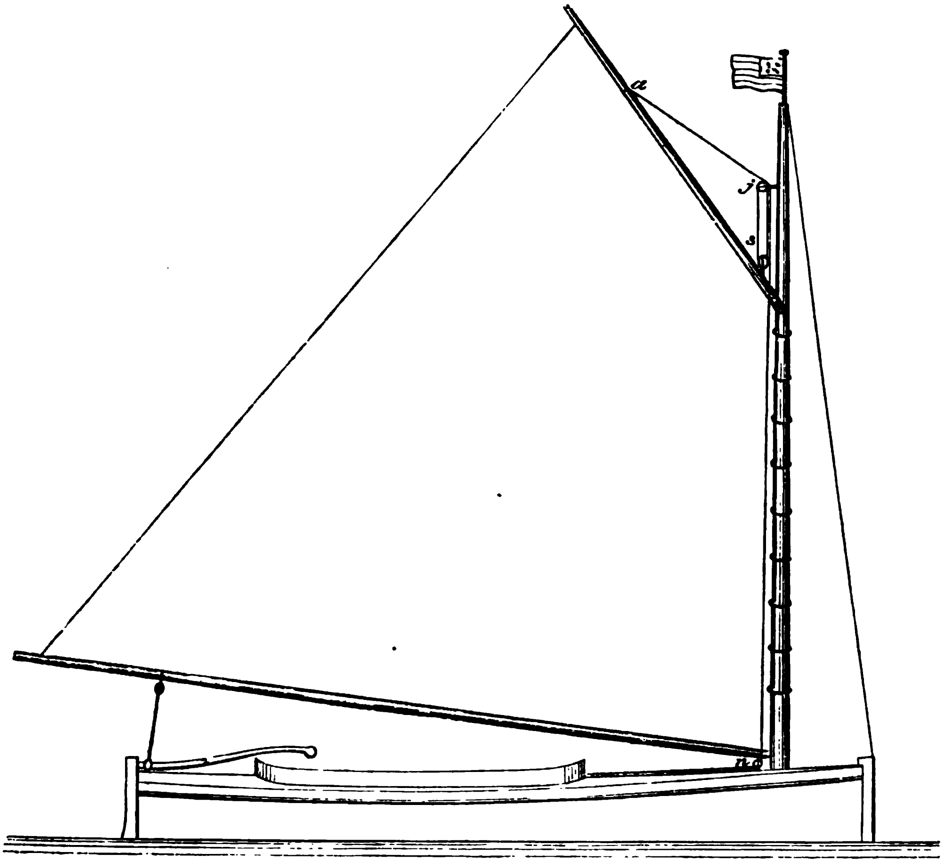
This tendency of coming to against the helm, is common to all shallow boats when they are sailed off the wind; and if the rudder of a boat has to be kept right across her to check the tendency, speed is of course very much retarded. As a rule it is found that lifting the centre board greatly relieves the weather helm; and as the board is not wanted down off a wind, to increase the lateral resistance it is always better to haul it up; the boat will steer all the better for it, and there will be less surface for friction.

Some boat sailers have used a small jib on a short bowsprit when sailing off a wind; the bowsprit would run out through an iron fitted to the stem head, and the heel could be lashed to the mast if no bitts were fitted, as there need not be. A shroud would be required each side, and a bobstay, but if the bowsprit were a mere bumpkin only three or four feet long, no shrouds would be required. If it were found necessary to luff up in squalls, the head sheets should be the first to be started, therefore they should lead aft. A few years ago a boat, built on the model of the Una, had her mast shifted to 5ft. abaft the stem and a jib or foresail added and mainsail reduced; she was found very easy on her helm when sailing off the wind, as might be expected; but on a wind she would not lie so close, and quite proved the inferiority of the two sails, so far as sailing in smooth water went. The advantages of the one sail are almost wholly confined to sailing to windward in smooth water and, as sailing to windward under such conditions is the principal charm of sailing a small boat at all, the Una rig will retain its popularity.

A shallow boat like the Una is a little more unsafe perhaps than an ordinary sailing skiff, because they carry so much sail; and a person might be tempted into pressing them, because of the enormous stiffness they show up to the time that their gunwale or deck becomes level with the water.

However, with skilful management "Unas" are safe enough, and on the whole, are not so dangerous as an open boat of similar length. They should be always luffed to squalls before their deck has a chance of being immersed, and a foot or two of main sheet (which should be held in the hand) given them if they cannot be relieved sufficiently without their being brought head to wind—a course never desirable if it can be avoided, as the boats soon lose steerage way. It is never advisable to let the main sheet go altogether with a boom sail, as it is with one without a boom, as the sail will not spill, and the boom may get in the water, which would be awkward, to say the least, if the boat got stern way on.

The "Una's" stores, copied from an inventory of the same, made when she was packed off by rail to Southampton, was as under: One mast, one boom, one gaff, one pair of oars, one sail, one sail cover, one hatch cover, one rudder and tiller, four blocks, one main halyard, two bell-metal rowing-pins, four pigs of lead ballast. All that need be added to this list is a "baler," and it would do for a Una of the present day.



SAIL PLAN "UNA" BOAT ¼th INCH SCALE.
FIG. 57.

The rig, it will be seen upon reference to the sail plan, Fig. 57, is simple in the extreme, and even the famed balance lug cannot beat it in this respect. The sail is hoisted by a single halyard, Fig. 57. The standing part is made fast on the gaff at *a*, then leads through a double block at *j* on the mast, through a single block *s* on the jaws of the gaff, up through *j* again, and down to the deck where the fall leads through a block *n* by the side of the mast, and belayed on the aft end of centre board case. The fall can then be taken aft to the hand of the helmsman, who, in case of need, can drop the peak without leaving the tiller. The Una had no stay at all, but the Cowes fashion now is to have a forestay, which prevents the mast going aft when sailing on a wind. The larger Una boats over 20ft. are fitted with a topping lift, and the smaller one would be all the better for it, as a lift is handy in setting, stowing, or reefing the sail.

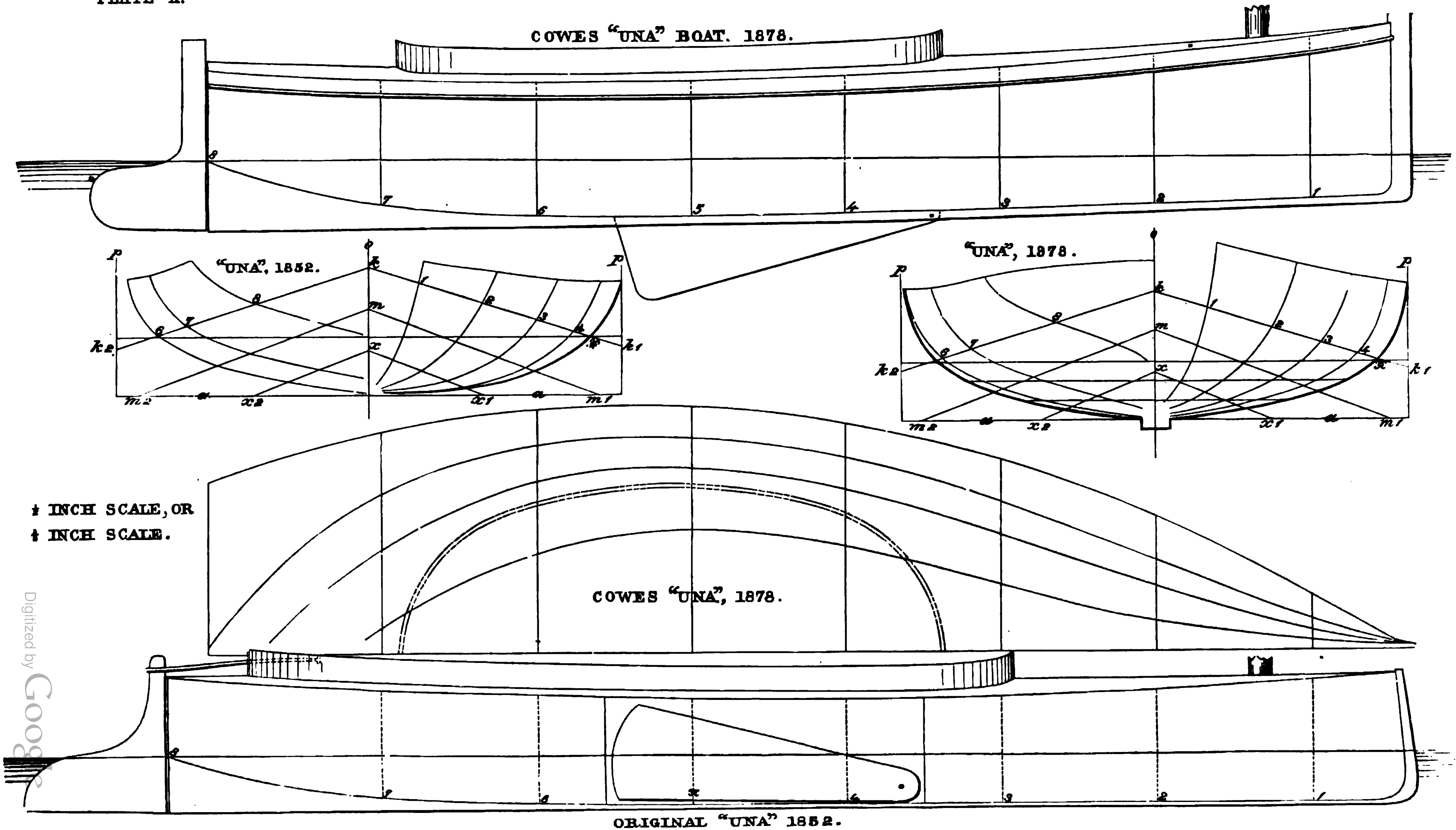
The main sheet is made fast to an eye bolt on one quarter, close to the intersection of gunwale and transom; it then leads through a block on the boom, and through a block on the other quarter, the fall coming into the well or cockpit to belay. This plan of fitting the mainsheet is still known as the "Una," just as the plan of working the halyards all in one is.

Practically, the Cowes Una boat of the present time differs very little from the original. The floor, it will be found, upon reference to the diagrams and tables, is a trifle flatter than the Una's; the quarters are lifted a little, as will be seen upon comparing the transoms; and there is more freeboard—the latter being a very desirable addition. The load waterline of the two crafts are almost identical, as will be found by comparing the half breadths for the same. The centre-boards are of about equal area, the only alterations being that the modern plan is to pivot the board in the keel below the garboard, whilst formerly they were pivoted in the case inside the boat. The Cowes Una has a trifle less draught forward than the original, and the stem piece does not tumble aft, but, in other respects, there is not much difference in the two sheer plans, always of course remembering the increase in the free board. The draught of water of the Cowes Una forward appears to be excessive, and off a wind at least she would be lightened by the head to the extent of three or four inches.

The design for a Cowes Una (Plate X.) has been made so that it is adapted for either a real "Una" of 15ft. 6in. in length, or one of greater size 21ft. in length. The sail plan of the Cowes boat is a smaller one than the Una had, but it will be found large enough for ordinary sailing. The sail, of course, will be laced to the boom, and a topping-lift would be found of service to keep the boom up when the peak is lowered, or when running off the wind.

We are indebted to Mr. John Hollis for the drawing of the Una. She is still in existence on the estate of Lord de Ros, in Ireland, the late Marquis of Conyngham having presented her to that nobleman about four years ago.

PLATE X.



COWES "UNA" BOAT. 1878.

"UNA", 1852.

"UNA", 1878.

COWES "UNA", 1878.

ORIGINAL "UNA" 1852.

⅛ INCH SCALE, OR
¼ INCH SCALE.

DIMENSIONS, &c.

	Una.		15ft. 6in.		21ft.	
	ft.	in.	ft.	in.	ft.	in.
Length, extreme	16	0	15	6	21	0
Beam extreme	6	6	6	6	8	8
Keel sided amidships	0	7	0	4½	0	6
Keel sided fore end	0	2	0	2	0	2½
Keel sided aft end	0	2	0	2	0	2½
Moulding (depth) of keel	0	2½	0	4	0	5
Floors sided	0	¾	0	1	0	1½
Floors moulded	0	1½	0	1½	0	2
Timbers sided	0	¾	0	·1	0	1½
Thickness of plank	0	½	0	½	0	¾
Thickness of top strake	0	¾	0	¾	0	1
Mast, deck to hounds	16	0	14	0	18	6*
Boom	18	6	15	6	21	0
Gaff	9	3	7	6	10	0
Luff of mainsail	12	0	9	9	13	0
Foot of mainsail	17	6	15	6	20	8
Head of mainsail	9	0	7	0	9	6
Leech of mainsail	19	0	17	8	23	6
Tack to peak earing of main sail	20	0	16	0	21	0
Clew to throat earing ,,	19	0	17	0	22	9
Centre of mast from the fore side of stem at L.W.L.	2	0	2	0	2	6
Diameter of mast at deck	0	4½	0	4½	0	5
Diameter of mast at hounds	0	2½	0	2½	0	2½
Weight of displacement of boat to L.W.L. (approximate)	13 cwt.		14 cwt.		1·4 ton	

* An American 21ft. Cat Boat would have about 3ft. more mast and 2ft. more boom. The Cat Boat's mast would rake aft ¾in. in 1ft.

LAYING OFF TABLE, ½IN. SCALE.

	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights to top of timbers above L.W.L.	1 6½	1 3½	1 1½	1 0	0 11½	0 11	0 11½	1 1
Una ,, ,, ,,	0 11	0 9½	0 8½	0 8	0 8	0 8¾	0 9	1 0
Depths below L.W.L. to rabbet	0 6½	—	—	—	0 9	0 8½	0 6½	—
Una ,, ,, ,,	0 7½	—	—	—	0 8¾	0 8	0 6½	—
Half-breadths on deck	0 8¾	1 9	2 5½	2 11	3 2½	3 1½	2 10	2 1¾
Una ,, ,,	0 7½	1 7	2 4	2 11	3 2¾	3 1	2 9¾	2 3
Half-breadths on L.W.L.	0 4¾	1 2	1 11¼	2 5¾	2 9½	2 8	1 11¾	—
Una ,, ,,	0 4	1 1	1 10¾	2 6	2 9¾	2 8½	2 1	—
Half-breadths on diagonal *k*	0 7½	1 6¼	2 2¼	2 8¼	2 11¼	2 10¼	2 5	1 4½
Una ,, ,,	0 7	1 5¼	2 2	2 8½	2 11¼	2 10½	2 5½	1 6¼
Half-breadths on diagonal *m*	0 6	1 2	1 8	2 0	2 2½	2 1	0 9	0 5½
Una ,, ,,	0 5½	1 1½	1 8½	2 1½	2 3¼	2 1	1 7	0 6
Half-breadths on diagonal *z*	0 3½	0 7½	0 10½	1 0½	1 2	1 1	0 9	—
Una ,, ,,	0 3¼	0 8	0 1	1 2¼	1 3	1 0½	0 7½	—

All the half-breadths are without the plank.

In the body plan of the Cowes Una the midship section is shown on both sides of the middle line, *o*, between Nos. 4 and 6 sections. The station for the midship section is shown at No. 5 in the sheer plan.

No. 1 section is 1ft. 3in. from the fore side of the stern; all the other sections are 2ft. apart, but No. 8 (transom) is 2ft. 3in. from No. 7 station.

In the case of the Una, No. 8 (transom) is 2ft. 9in. from No. 7 station.

Diagonal *k* is struck 10¾in. above the L.W.L., and at *k* 1 and *k* 2 cuts the side perpendiculars *p p* 1½in. below the L.W.L.

Diagonal *m* is struck 4½in. above the L.W.L., and at *m* 1 and *m* 2 is 3ft. out from the middle vertical line *o*.

Diagonal *s* is struck 1¾in. below the L.W.L., and at *s* 1 and *s* 2 is 1ft. 6in. out from the middle vertical line *o*.

The base line *a a* is 9 inches below the L.W.L. and parallel thereto.

LAYING-OFF TABLE FOR 21FT. "UNA" BOAT, ½IN. SCALE.

	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of timbers ...	2 0¼	1 8½	1 6	1 4	1 3	1 3	1 3¼	1 5¼
Depths below L.W.L. to rabbet..................	0 8¼	—	—	—	1 0	0 11¼	0 8¾	—
Half-breadths on deck	0 11¾	2 4	3 3¼	3 11	4 3	4 2	3 9¼	2 10
Half-breadths on L.W.L.	0 6¼	1 7	2 6¼	3 4	3 8	3 6¼	2 7¼	—
Half-breadths on diagonal *k*......................	0 10¼	2 0¼	2 11¼	3 7¼	3 11¼	3 10	3 3	1 8¼
Half-breadths on diagonal *m*	0 8	1 6¼	2 3	2 8	2 11¼	2 9¼	2 1¼	0 7¼
Half-breadths on diagonal *s*	0 4¾	0 10	1 2¼	1 4¾	1 7	1 5¼	1 0	—

All the half-breadths are without the plank.

No. 1 section is 1ft. 10in. from the foreside of the stem; all the other sections are 2ft. 8in. apart, but No. 8 (transom) is 3ft. 2in. from No. 7 station.

Diagonal *k* is struck 1ft. 2½in. above the L.W.L., and at *k* 1 and *k* 2 cuts the side perpendiculars *p p* 2 inches below the L.W.L.

Diagonal *m* is struck 6in. above the L.W.L., and at *m* 1 and *m* 2 is 4ft. out from the middle vertical line *o*.

Diagonal *s* is struck 2½in. below the L.W.L., and at *s* 1 and *s* 2 is 2ft. out from the middle vertical line *o*.

The base line *a a* is 1ft. below the L.W.L. and parallel thereto.

CHAPTER XVII.

MERSEY SAILING BOATS.

NEW BRIGHTON SAILING BOATS.

Open boat sailing is a favourite pastime on the Mersey, and if a man wishes to become thoroughly acquainted with the art as it can be practised in a really "nasty sea," he should spend a season among the New Brighton boat sailers.

The boats formerly carried three spritsails and jib (see page 188), like the Liverpool river gigs, and reefed by lowering mainsail, or by shifting the mainsail to the fore thwart and stowing foresail. This rig is still sometimes met with, but the boats are now commonly rigged with fore lug, sprit mizen, and a jib. Elaine, however, has lug mizen instead of a sprit. For very light winds a big lug is set on a mast stepped in the centre thwart during reaching or running; but we believe it is not used on a wind, although one boat (the Naomi), in a light breeze, managed to do so in the summer of 1877 by topping the fore boom in stays, and so contrived to win.

The boats now differ somewhat from those of a few years ago, the principal change being the introduction of a counter. The counter, it may here be said, is a great assistance to small boats, as it enables them to have longer and better buttock lines, and hence a better or cleaner delivery, no eddies being formed astern. Further, with the counter they have more power with a beam or head wind, and run before a sea drier, and much additional room is obtained on board for working the aft sails. The counters are limited in length to 4ft. 6in., and must be clear of the water at the sternpost when ballasted and in trim for sailing, but without crew on board.

The boats are not allowed to be decked, and no appliances are permitted to keep out water; they have, however, a kind of "fore peak" forward, by fitting a platform level with and forward of the fore thwart, and the counter may be decked as far as the sternpost. To get rid of the water that may be shipped, a 3½in. pump is fitted amidships, with a discharge both sides.

The freeboard is cut down as much as possible, as it tells in the "girth" for measurement; in the design given an attempt was made to compensate somewhat for this deficiency by wash strakes aft.

The particular kind of craft now in use is shown by Plate XI., which represents the Elaine. The Elaine was designed last summer for Mr. John Bouch (Com. N.B.S.C.) by Mr. C. P. Clayton, of Park Road, Birkenhead, and to him we are indebted for particulars of the new Brighton boats. The Elaine has less displacement than these boats are usually given, and a low freeboard was decided upon, to reduce the girth measurement as much as possible.* She was most successfully sailed against all the crack boats of the club last season, and won five prizes for eight starts.

The length of the Elaine from fore side of stem to aft side of sternpost is 23ft. 3in., and her greatest beam 6ft. 4in.; her greatest draft aft with crew (six hands) on board is 3ft. She has 6cwt. of iron on her keel, and 2cwt. of iron inside.

Some of the New Brighton boats are, however, of much heavier displacement. Thus, the Tyro (a very successful boat, designed and sailed by her owner, Mr. G. H. Willmer), has 24cwt. of iron ballast, 6cwt. of which is on the keel. The weight of the boat is about 14cwt., and of her gear about 6cwt. Her displacement with crew on board is 2·7 tons (54 cwt.). Other boats have 14cwt. or 15cwt. of lead ballast, 8cwt. or 9cwt. of which are placed on the keel. All these boats have deeper and fuller bodies than Elaine, and a trifle less beam.

The displacement of Elaine to the load water-line shown in the drawing (supposed to be with six hands on board) is 2 tons. The light displacement which brings the counter out of water, as at x (see Sheer Plan), is 2in. less or equal to half a ton less. The displacement per inch of immersion at the load water-line is ·25(¼) ton.

Six men of about 12 stone each would weigh half a ton, but probably such a heavy crew would not often be found. This number is not found too many for working the sails; and, as a light-displacement boat like Elaine depends so largely on her crew for ballast and stability, it is a serious matter to be one hand short. Probably, as in the case of the centre-board gigs before referred to, five or six hands sitting to windward are much

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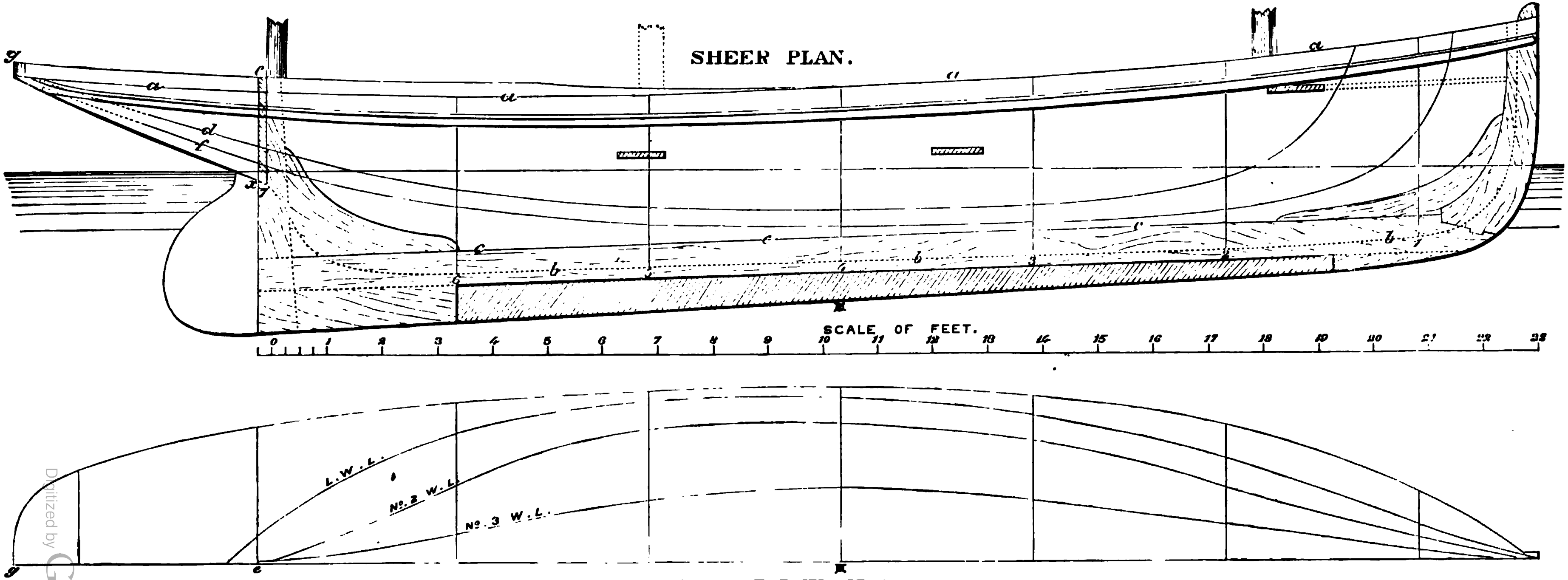
* The measurement rule of the New Brighton Sailing Club is as follows: "Take the extreme length from fore part of stem to after part of sternpost; girth at greatest *circumference*, by passing a line from gunwale under the boat's bottom, and back to the same point on the same gunwale. The total size of the boat is obtained by multiplying the girth by 1ft. 7in. (1·58ft.), and adding the product to the extreme length. The boats to be raced in one class, and the maximum size of the racing boats to be 50ft. club measurement." Applying this rule to Elaine, we have greatest girth 16ft. 10in., and length 23ft. 3in., thus summed: 16·83 × 1·58 + 23·25 = 49·84ft.

PLATE XI.


SHEER PLAN.

HALF BREADTH PLAN.

"Elaine," New Brighton Boat.

more potent as a means of acquiring stability than any practicable quantity of lead or iron in the bottom of the boat or on the keel would be. In light winds the crew would stow themselves in the bottom of the boat; but the "half-ton" stowed well to windward is indispensable in anything like a breeze blowing abeam or on the bow.

Of course, with so much weight on the keel, and such great draught and rising floor, these boats cannot very easily be "beached" or hauled up, as the Brighton beach boats are; and on the Mersey they usually lie afloat. However, it is possible with a cradle to haul such a boat up, and it would be very interesting to see one of them in competition with the south-country boats during the ensuing season.

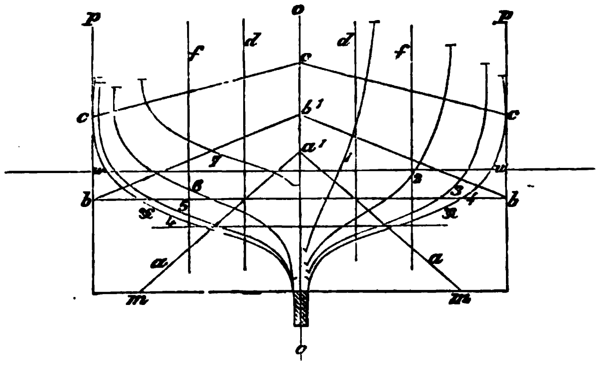


Fig. 58. Body Plan of "Elaine."

The following measurements and particulars refer to the design of the Elaine:—

	No. 1 Section.	2	3	4	5	6	7	8
Sheer Plan.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of rail	2 3½	1 10½	1 7½	1 5	1 8½	1 8½	1 5	1 7½
Depths to rabbet-line of keel	1 2½	1 5	1 6½	1 8	1 9½	1 11		
Half-breadth Plan.								
Half-breadths at gunwale rail	1 1¾	2 5½	2 11½	3 1½	3 0½	2 10½	2 5½	1 8
Half-breadths L.W.L.	0 6¾	1 9½	2 7½	2 11½	2 10½	2 3½	0 5½	
Half-breadths No. 2 W.L.	0 4½	1 3½	2 1½	2 5½	2 3½	1 4¾	0 1½	
Half-breadths No. 3 W.L.	0 2	0 7½	1 0½	1 3¾	1 0½	0 5½	0 1½	
Body Plan.								
Half-breadths on *a* diagonal	0 7¾	1 4	1 7½	1 8½	1 7½	1 8½	0 5½	
Half-breadths on *b* diagonal	0 10	1 11½	2 8	2 11	2 10	2 4½	1 5½	
Half-breadths on *c* diagonal	1 0½	2 4	3 0½	3 3½	3 2½	2 11½	2 4¾	

All the measurements *include* the thickness of the plank.

In the Sheer Plan the heights are measured to the top of the gunwale, lettered *a;* the depths to the lower edge of the rabbet of the keel *b*.

The top of the keel is shown by *c*.

In the Body Plan (Fig. 58) the diagonal *a* cuts the base line at *m* and *m*, 2ft. 5½in. from the middle vertical line *o;* and at *a* 1 the diagonal cuts *o* 3in. above the load water-line *w*.

The diagonal *b* cuts the perpendiculars *p p* on the second water-line as shown, and cuts the middle vertical line *o* at *b* 1, at a distance of 10in. above the load water-line *w*.

The diagonal line *c* cuts the perpendiculars *p p* 9½in. above the load water-line *w*, and cuts the middle vertical line *o* at *c* 1, at a height of 1ft. 7½in. above the load water-line *w*.

The buttock line *d* is 10in. from the middle vertical line *o* (Body Plan), and the buttock line *f* 1ft. 8in. from the middle vertical line *o*.

The vertical sections are 3ft. 6in. apart, and No. 1 section is 2ft. 2in. from the fore side of the stem plumb with load water-line. The water-lines are 5in. apart.

The counter is 4ft. 6in. long, measured from aft side of sternpost or transom at *e* to *g*. (See Sheer Plan and Half Breadth Plan.)

The keel is sided amidships 3in., tapering to 2½in. at the ends. The keel is 8in. deep, 6in. of which is worked inside, and 2in. outside below the rabbet.

The transom (7 station) is solid, 1¼in. thick.

The frames are 1½in. sided, 2in. moulded at heels of floors, and tapering to 1in. at timber heads. Three bent or steamed frames come between each pair of stations shown on the Sheer Plan.

The stem and stern posts are 2½in. sided.

The foremast is stepped 5ft. from the fore side of the stem; the mainmast 16ft. 3in. from the fore side of the stem.

The sails of the Elaine are slightly different to those of the other lugs in use on the Mersey, as they are cut with an excessive roundness to the head (see Plate XII.). Mr. C. P. Clayton informs us that he became acquainted with this plan in Callao and Monte Video, and strongly recommends it as a good expedient for making a sail sit flat. The head of the fore lug of the Elaine has as much as 19in. round, and the yard was bent to nearly fit the sail, or to the extent of 15in. (The yard could be bent by being balanced over a beam with a weight at either end, or it could be shored down at either end, for a week or two.) Mr. Clayton says the sail has never puckered along the yard in consequence of excessive round in the head, nor has it ever shaken in the leech; in fact, it sits like a drum-head.

The yard is 3½in. in diameter at the centre, and tapers well towards the ends. A rock-elm batten, 1in. thick and tapering at the ends, is made to fit the yard by grooving, and runs nearly the whole length of the yard, and is secured to it by lashings or lacings. The yard should be made longer than at first required, as the head of the sail frequently requires pulling out.

The foremast is 4¼in. in diameter; it is fixed into a clamp at the after side of the fore thwart; it is stayed with two light wire shrounds set up with lanyards to the gunwales. The purchase to the jib and purchase to the bobstay hold the mast forward.

The fore halyards are single 2½in. rope, leading through a sheave in the centre of the mast, and the yard is hoisted "chock-a-block," the heel or lower part of the yard being kept to leeward. There is a traveller on the mast, as shown in Fig. 59: *a* is the mast; *b* is the traveller; *c* is a hook (a solid weld on the traveller), with an eye at *d*, to which the halyard is eye-spliced, seized or bent; *e* is a selvedge strop round the yard *y*, just long enough to have a thimble seized in it, to take the hook at *c*; *f* is the sheave in the mast; *g* is the halyard, but not hauled taut.

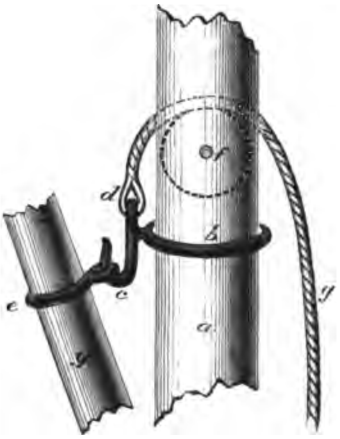


FIG. 59.

The tack of the sail is set down by a gun-tackle purchase leading from an eye-bolt on the keelson of the boat; Mr. Clayton, however, says he will have a double purchase in future, as it takes two or three hands to bowse the tack down with a gun-tackle purchase. Unless the luff of the sail is kept taut, the peak drops and lets the boom down, but never inconveniently or harmfully, and a small pull on the mainsheet puts the matter right. However, there can be no doubt that the peak, if possible, should be kept well set up, and a taut luff will generally succeed in doing this. The tack, tack cringle, and luff rope of the sail must be very strong, to stand the enormous strain put upon it. The head of the sail must be very tightly laced, and the lacing holes are best sewn, instead of "eyeleted."

The boom is fitted to the mast by a goose-neck, made to ship and unship without collar, nut, or pin; the fall of the tack tackle, being generally belayed round the boom at the mast, keeps the boom in its place.

The clew of the sail must be free whilst the tack is bowsed down, the clew is then hauled out on the boom by a traveller similar to the mast traveller. The boom should be a good stiff stick, as, if it bends, a slack leech and belly to the sail will be the result. The sheet is a gun-tackle purchase, and on a wind the boom is hauled in as flat as it can be got.

In tacking, the heel of the yard is pulled the other side of the mast by main force as the boat comes head to wind; a short line fast to the heel of the yard is found to facilitate this operation.

In lowering the sail the first thing to do is to let the clew loose and cast off the tack.

In reefing, the tack tackle and hook of the boom traveller are shifted to the reef cringles, the sail set up, and then the reef points tied. Points are put close to the reef cringles, to tie the ends up snugly. The reef bands are 2ft. apart.

The mizen is set the same as the mainsail, but the tack and clew are made fast to the boom by lashings, as the heel of the yard can be easily shifted.

Mr. Clayton says that the Monte Videan boats have a claw on the heel of the yard, made as shown by Fig. 60, to fit on the aft side of the mast; then no dipping is required at all. *a* is the yard, *c* the claw, *d* the mast. Sometimes, instead of a claw, a double iron is used, the part which encircles the mast being hinged and fastened by a pin. These contrivances serve to keep the yard steady whilst reefing, and admit of the tack tackle being dispensed with; these plans, however, are not allowed by the New Brighton Sailing Club, as they partake of the gaff plan. Mr. Clayton, moreover, prefers the tack tackle, as it fairly brings a strain on the luff and foot of the sail.

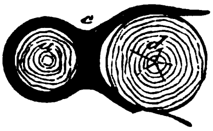


Fig. 60.

The topmasts are generally put up through a split cap *c* (Fig. 61) on the mast head *m*. The top mast is got on end by hand. The halyards and backstays are cleared torough the gap *a*. The heel of the topmast has a rope rove through it, by which it is lashed to the mast. Mr. Clayton adopted another plan in the Elaine, thus:

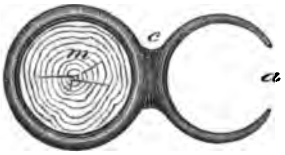


Fig. 61.

An iron cap, A (Fig. 62), is fitted to the topmast *k*, and remains on the topmast a fixture; when the latter is got on end it is shoved up in front of the mast, and "shipped" by putting the part of the cap *a* over the masthead (*m*) as the topmast is got up. The heel of the topmast is then lashed to the mast. The part of the iron *a* must fit loosely on the masthead. Sometimes the parts *a* and *k* are made equal; in such case the masthead, or "pole" of the mast, must be reduced to the size of the topmast. The iron cap is riveted as shown at *r*. B shows the masthead, with topmast, and iron cap fitted on at *a* and resting on the iron rigging hoop *d*. The shroud *s* is hooked to an eye in the rigging hoop *d*. The jib halyards *h* are hooked to an eye at the fore side of the hoop. The Elaine's topmast is 20ft. long, with the cap in the centre of length.

Two or three of the boats have topsails on bamboo yards; but they are of no use on a wind, and do not give much additional area. On the other hand, they add to the gear; and, as the boats are already full of necessary sails, gear, and spars on match-sailing days, everything in the slightest degree superfluous is rigidly condemned.

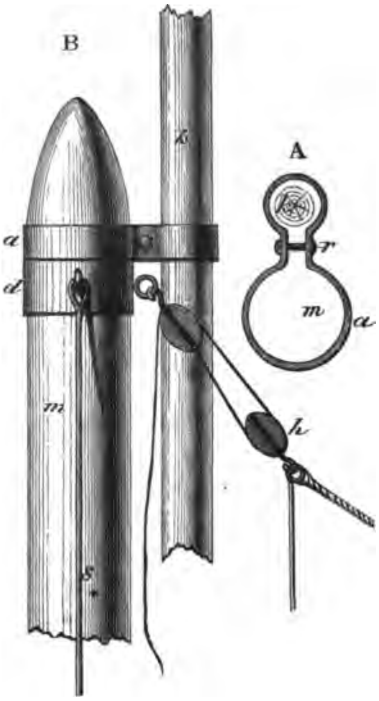


Fig. 62.

The bowsprit is shipped through an iron hoop on the stem, and the heel fitted into a socket in the mooring bitt, which is fixed about a foot ahead of the mast; the bobstay is of wire, and is set up with a gun-tackle purchase, the outer block being hooked into an eye at the end of the bowsprit.

There are no shrouds to the mizen mast; the sail is hoisted by single halyards. The foot of the sail is generally laced to a boom. The sheet is taken down to a short bumpkin which ships and unships, and projects about 3ft. beyond the taffrail. The standing part of the sheet is fast to the bumpkin end, it then leads through a strop block on the boom, down through a sheave in the bumpkin end, and from there leads on board. The mizen mast is shipped into a clamp, at one side of the rudder, at the fore side of the transom. Care must be taken that there is plenty of drift between the mizen boom and bumpkin, so as to get the sheet well in.

The jib sheets are led through an eye bolt inside the gunwale, or on one of the fore-thwart, knees; they lead aft, and are belayed to a pin in the centre of the thwart, and can consequently be handled without going to leeward.

The main sheet is single, and works on a short iron horse about 1ft. 2in. long, secured to a thwart about two-thirds of the length of the boom from the mast. The standing part of the sheet is fast to a single block on the traveller; it leads through a single strop block on the boom (or a clip hook block, hooked into strop), then back through the block on the traveller and the fall hitched round the parts.

All the boats have jibbooms (for carrying balloon jibs), and these are shipped the same as the topmasts, with a gap in the jibboom iron or cap on jibboom.

The sail plan of the Elaine, scaling one-eighth of an inch to a foot, is shown on Plate XII. The dimensions of the sails are as follows:

	Luff.		Leech.		Head.		Foot.		Tack to peak earing.		Clew to throat weather earing.	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
Foresail, *a*	5	0	26	0	21	6	16	0	25	0	17	0
Mainsail, *b*, for running	10	0	28	6	18	6	18	0	27	6	21	0
Mizen, *c*	3	0	14	0	18	0	9	0	15	0	9	6
Small sprit foresail, *d*	10	0	20	0	10	0	14	0	19	0	17	0
Balloon jib, *e*	20	0	14	0	......		18	6				
Working jib, *o*	16	6	12	6	......		10	6				
Small jib, *f*	15	0	10	0	......		7	6				
Spinnaker, *s*	29	0	23	6	......		22	0				
Big spinnaker, *p*	33	0	23	6	4	6	30	0				

i **Bobstay of jibboom.** **The reference letters refer to Plate XII.**

Mainmast from heel (stepped on top of keel) to sheave hole, 20ft.; foremast ditto, 17ft.; diameter mainmast, 3½in.; foremast, 4¼in. Fore yard, 21ft. 8in.; diameter 3⅛in. Fore boom (mast to outhaul sheave), 16ft. 6in.; diameter, 4in. Topmast, 20ft.; above cap, 10ft.; diameter, 2½in. Bowsprit, 7ft. outside; diameter, 3½in. Mizen mast, 10ft. 9in.; diameter, 3½in. Two spinnaker booms, 21ft. and 27ft. long respectively.

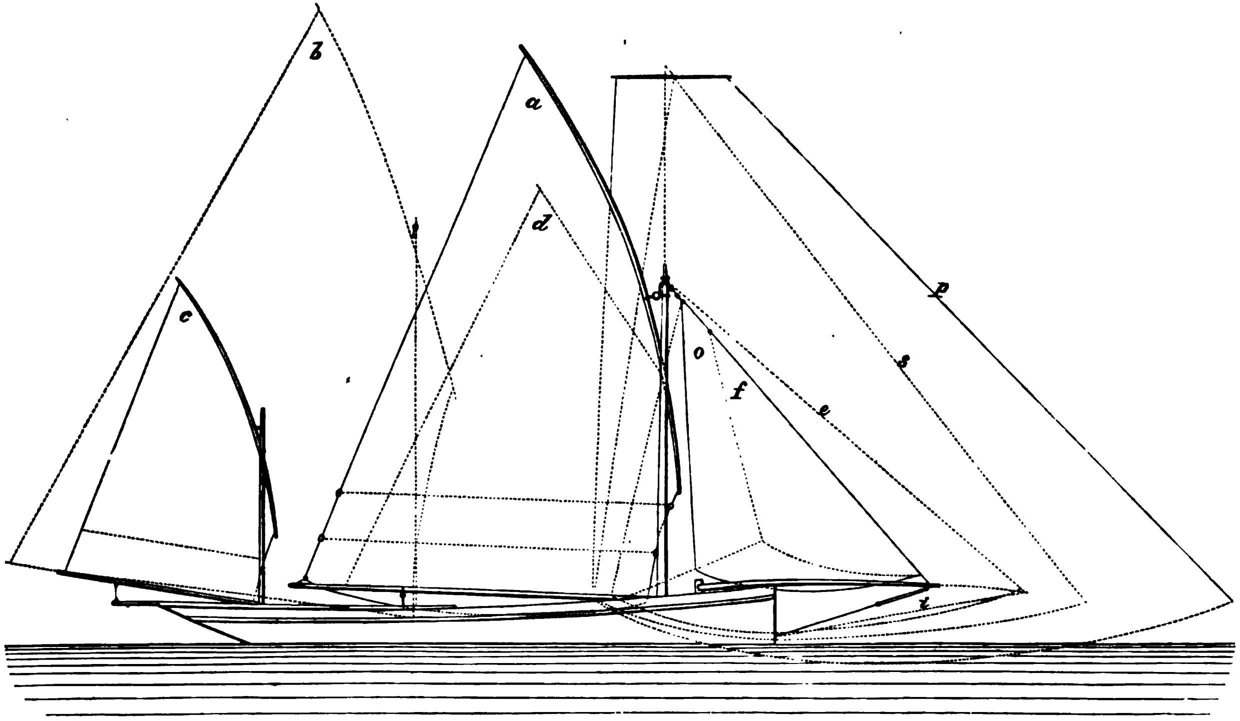
Generally the New Brighton Sailing Club boats are moored at the back of the Woodside, or New Brighton stages, and are consequently obliged to unship their masts. Only a few of them are moored sufficiently in the open to enable them to keep their masts standing.

When laying at moorings, the spars are generally secured at one side of the boat, and the sails at the other, covered over with one large sail cover, and lashed to the thwarts.

A little practice soon enables the crews to get up all working sails in five or six minutes. The foremast and bowsprit are first shipped. The jib is the first sail set, to act as a forestay, to keep the head of the mast forward; the jib is hauled out with a single outhaul, the halyards having a gun tackle purchase. Belaying pins are placed at the after side of the foremast thwart for securing halyards, &c.

When the jib and jigger are set, the boat is manageable, and can be

PLATE XII.



Sail Plan of "The Elaine."

cast off from her moorings, the big foresail being put up last; this is done, by first hooking on the tack purchase, then getting the yard into position, so that the grommet strop can be hooked on to the mast halyard traveller; when hoisted the tack is bowsed down, a double purchase being necessary in boats of the Elaine size; last of all, the clew of the sail is hooked into the boom outhaul traveller, hauled out, and the fall secured to a cleat on the lower side of the boom.

The main sheet is generally kept in well taut on a wind, the boom not being allowed to sag away over the side, which it would do if the sheets were double and taken down to the gunwales.

The lug yard is always kept to leeward of the mast, and as the halyards are rove through a sheave placed fore and aft, in the centre of the mast, it produces a tendency to keep the head of the sail to windward.

In smooth water the boats will always easily stay, under almost any sail, but in rough water, the helmsman must watch his chance so as not to get a lump of sea on his weather bow just before the boat gets up in the wind; the helm must be put down gradually, so as not to stop the boat's way; the jib is passed over as soon as the boat has properly paid off, and gradually eased over, so as not to stop her way. It is often advisable to ease the jib sheet at the same time the helm is put down, and if the boat shows signs of missing stays, a hand going into the bows tends to bring her head to wind (this being a recognised dodge with Liverpool speculating gigmen),* and this hand can hold out the clew of the jib, and so, if necessary, force her round—care, of course, being taken to reverse the helm if the boat gets stern way on her.

Hauling in the last inch of the jigger sheet, just as the helm is put down, is advisable in racing, and makes a boat stay quickly by reducing the angle of the after sail, and easing and not taking it in again until the boat is well under way, allows her to start again quickly.

The mizen lug yard is easily pushed by the helmsman to the lee side of the mast, but the fore lug yard requires a little handling: the easiest and best way to get it over, is by fixing a couple of light ropes, about a fathom long, to the foot of the yard, the ends being allowed to drop down at each side of the boom, and by hauling in the weather one, just before the boat comes upright in stays, the yard bends slightly, and passes round the left side of the mast, and flies into its position to leeward, ready for the next tack, this can be done by one hand without jerking the boat unnecessarily, for the most essential element for speed in these as in all other light boats is to get the crew to keep quiet, and if necessary to lay well up to windward, often to the extent of getting one leg and part of the body over the weather side—as the spare spars and sails are lashed up to the sides of the boats, they assist the crew in keeping this position.

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* The practice of going into the lee bow of a boat as the helm is put down is a very old one; by immersing the bow to leeward, the pressure is increased and the boat's head forced to the wind. On the other hand, by collecting the crew on the weather bow as the helm is *put up* the boat will wear, or bear up faster. The author of an article on seamanship in the *Encyclopædia Britannica*, in allusion to this subject, says "A practice of seamen in small wherries or skiffs, in putting about, is to place themselves to leeward of the mast. They even find they can aid the quick turning motion of these light boats by the way in which they rest on their two feet, sometimes leaning on one foot and sometimes on the other. And we have often seen this evolution (tacking) very sensibly accelerated in a ship-of-war by the crew running suddenly to the lee bow as the helm was put down. And we have heard it asserted by very expert seamen, that after all attempts to wear ship (after lying to in a storm) have failed, they have succeeded by the crew collecting themselves near the weather foreshrouds the moment the helm was put up." The man that goes into the lee bow to help bring the boat head to wind should not remain there, but move aft to the quarter on the opposite side; this will assist the boat's head in falling off. (See also page 29; also see "Sternway" in the chapter on "Seamanship.")

Most careful handling of the helm is necesssary in rough water, as a very slight touch will often keep a sea out. It is generally found that the light displacement boats are the liveliest, and driest, in rough weather; and those that take a large quantity of ballast have a high freeboard to keep them dry. A club-footed section forward prevents a boat dipping and taking in volumes of water over the bows, but it is decidedly detrimental to speed in lumpy water, as it produces continual bumps on to the top of the seas, and so stops the boat's way; a long floor with hollow sections near the keel under the mast seems to answer best.

In reefing the fore lug, the halyards are lowered the necessary distance down the mast, then the hook of the tack tackle block is hooked into the reef cringle in the luff, and the tack bowsed down; the clew outhaul traveller hook is then placed into the opposite reef cringle in the leech, and the clew hauled out; last of all, the foot of the sail is rolled up, and tied with the reef points; reef points are also placed close up to the cringles, to make the ends of the sail snug. This can be done so neatly, that the reefed sail looks as if it had been changed for a smaller one; and as it can be done easily and quickly with practice, it is infinitely preferable to changing sails, and is of great advantage when racing. Reefing the mizen and changing jibs is also often necessary.

The calico lug for running (see *b*, Plate XII.) is generally kept in the boat bent, with the head laced to the yard, and foot to a boom; the running-lug mast is the full length of the boat inside, and is shipped into a thwart, about two-thirds the distance aft, between the fore and mizen masts, a single light rope backstay is used, and the yard is hoisted with single halyards, and the tack hauled down with a light line to a hook in the thwart, the sheet is always attached to the boom, and does to make up the sail with, it is led over a fair-leader aft in the counter, and then led inboard. The jigger can be unshipped or brailed up, to allow the big sail to receive all the wind.

Topping lifts are fitted to the working lugs for handiness, and to enable the fore boom to be shifted to the other side of running lug; this running lug is only used for running or reaching with a beam wind, and would only sit in a very light air to windward. (See page 177.)

The balloon jib is hoisted by ready rove single halyards; the jibboom is shipped with the outhaul ready rove, no bobstay being of any use; after the sail is got out on the jibboom, the sheet is passed well aft, clear of, and outside, all other gear and rigging to leeward, then, when the halyards are hoisted, the sail is set: these balloon jibs add greatly to the speed in reaching, being very large, and cut with a round foot, which hangs close to the water.

In setting the spinnaker, the topmast having been got on end (as already explained, with a backstay fitted to the shoulder, and halyards ready rove), the backstay is first taken aft and secured; the guy is passed outside the rigging; the halyards and sail are on the fore side of the mast shrouds and hoisted chock-a-block, being passed through the space between the mast and the rigging the sheet is secured to the bowsprit, or lee gunwale; the guy is bent to a small rope cringle in the tack of the sail; the cringle is of sufficient size to take the spritted point of the spinnaker boom, which is then pushed forward, and the goose neck at the inner end shipped into a socket on the mast, or into a rowlock hole in the gunwale ahead of the rigging. It is drawn aft by the guy, and trimmed to the wind. A hand is kept to sit on the boom to keep it down.

A topping lift is used for the big spinnaker booms, then the boom is shipped into its place before the sail is hoisted, care of course being taken that the outhaul is outside the topping lift, and runs clear of the guy. These points being continually forgotten by amateurs, it is advisable to mention them here, half of the time generally employed in setting a spinnaker is wasted in getting the gear straight (see "Seamanship").

In the New Brighton Sailing Club races the boats generally make a flying start, the boats being allowed to pass the line as soon as they can after the second gun, the boats only start from moorings when the tide is too strong to head against, or the wind is light and in the same direction as the tide.

A few years ago the new Brighton boats had no counters, as already explained, and Plate XIII. represents such a boat, named the Jabberwock. She was designed by Mr. Clayton, and was very successful.

The Jabberwock (see Fig. 63 for her body plan) had a length between stem and stern post of 26ft. 6in., and greatest beam of 6ft. 9in., and she had no counter. Her draught aft was 3ft; amidships 2ft. 5in. She had 7cwt.

of ballast outside on her keel, a 4½cwt. inside, besides a crew of five or six.

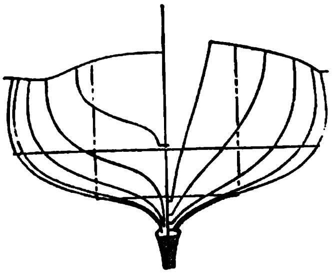


FIG. 63.

The boat sailed well with jib, sprit-foresail and mizen (see Fig. 64), and was very handy; the main-sprit being only set in light weather. A very snug rig was made by stepping the mainmast in the thwart shown by the ticked line; jib tacked to stem head and reefed mizen.

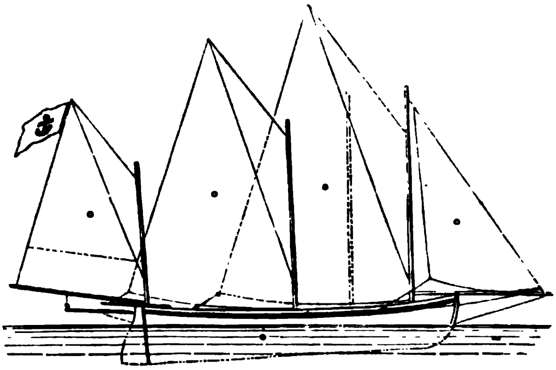
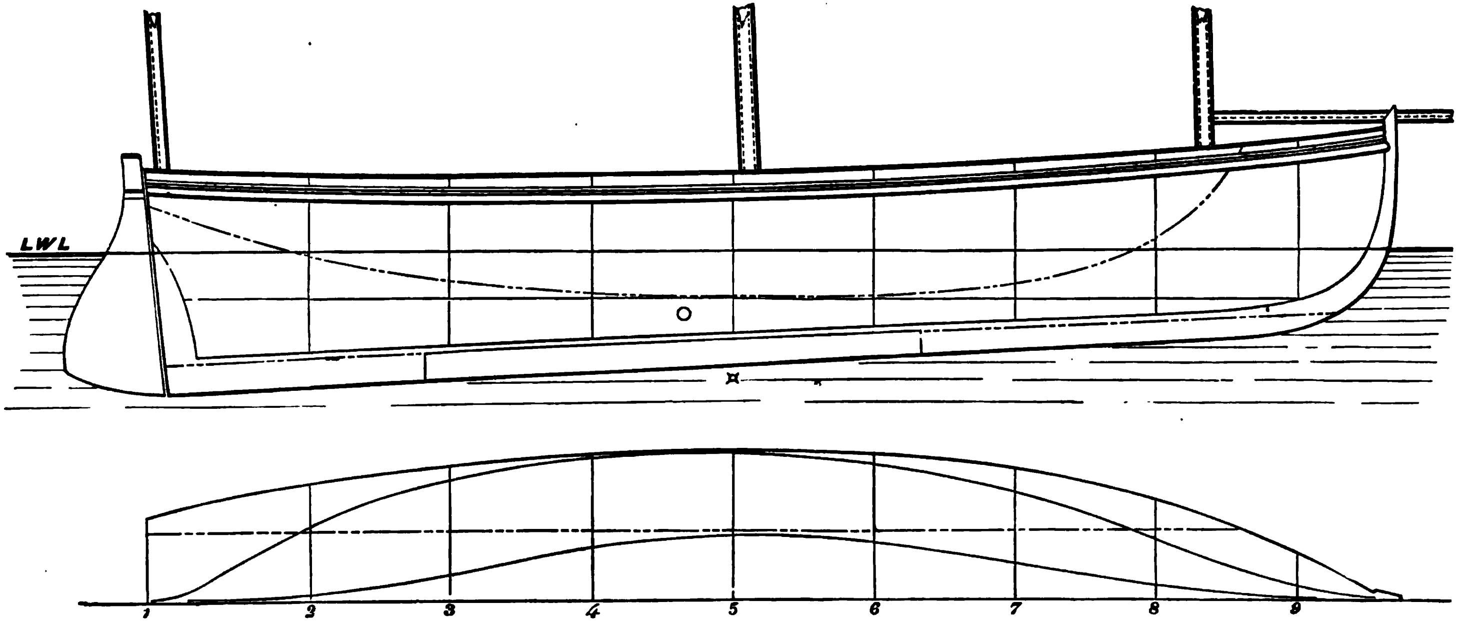


FIG. 64.

MERSEY SAILING CANOES.

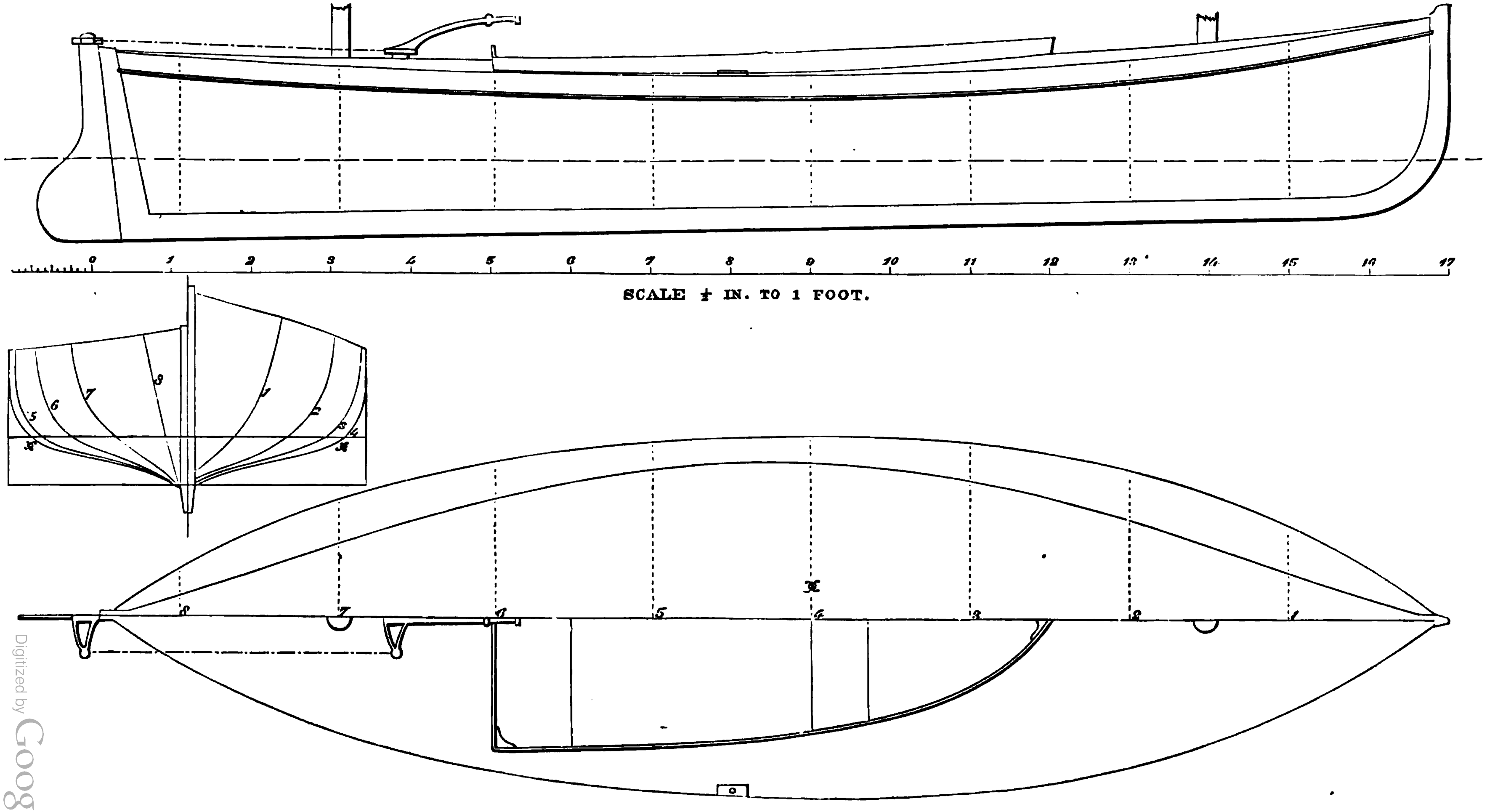
A class of boat is rapidly getting into favour on the Mersey, which, in some respects, is better adapted for the combined recreation of "rowing and sailing" than are the celebrated Surbiton gigs. We are indebted to Mr. C. Arthur Inman for a description and drawing of the Mersey craft (Plate XIV.); and it would be strange indeed if that home of "canvas-backs" did not turn out something specially serviceable in the way of boats. Although these Mersey sailing boats are termed "canoes" and "canoe yawls," it is quite plain that they are as much "sailing boats" as the Surbiton gigs are. It is true that they have grown out of the Rob Roy canoe; but a vessel

PLATE XIII.



"The Jabberwock."

PLATE XIV.



MERSEY SAILING CANOE.

17ft. long, 4ft. 6in. broad, and 2ft. deep, that carries "passengers," 1cwt. of ballast, has a large sail area, and is, moreover, rowed and not "paddled," is better described by the word "boat" than "canoe."

The boats are usually of one length, 17ft.; and a breadth of 4ft. 6in. is found to answer well. The depth from gunwale to under side of keel is 2ft., and the keel is 4in. deep. They are decked all over, excepting the well, which has 1½in. coaming all round, and is usually of the form shown in the drawing. The well is carried so far forward to enable the crew to reach the mast, or anything forward of it, without getting on the deck. The canoes are clench built, of white or yellow pine ⅜in. thickness when worked up. The stem and sternpost are alike, 1½in. sided, with 2½in. outside rabbet, and about 3in. inside, enough to take the plank fastenings and serve as apron.

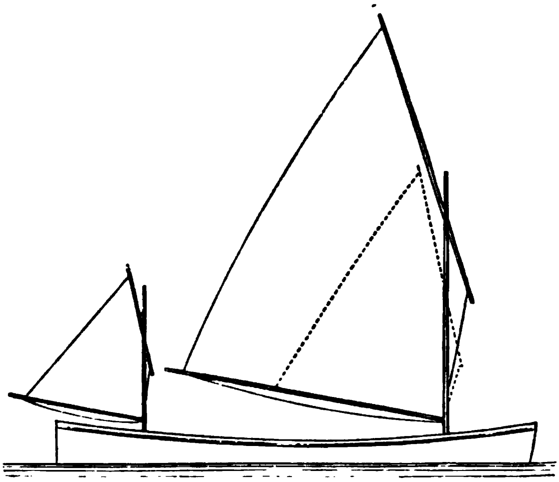


FIG. 65.

The steering arrangement is very capitally contrived with yokes coupled by rods or chains and a tiller, as shown. Strengthening pieces (running fore and aft) are worked above and below the deck, through which a bolt with collar passes, and is secured with nut and washer underneath. On the upper part of the bolt, above the collar, the yoke and tiller (all in one) are shipped on the bolt, and kept from unshipping by a pin. In case the tiller and yoke be of wood, a brass socket is fitted in the hole to prevent the collar of the boat wearing away the wood.

Generally about 1cwt. of ballast is carried, in flat lead or iron bricks. The boats carry three passengers; two sitting aft on the stern sheets, and one on the fore seat.

The rig, it will be seen, is the main and mizen; and in strong winds, with small mainsail and small storm mizen, they sail fast, and are dry. As they are decked in, these little boats may be seen out in all weather, and are considered as dry and safe as the New Brighton boats; but, of course, could not compete with them.

In form the boats are comparatively full forward, and have a long clean after-body; compared with the usual run of sailing boats, they are longer in proportion to their breadth, but if cut off at No. 7 section they would not much differ from the ordinary sailing boat.

The 4in. keel is found quite sufficient, in the way of deadwood, to check lee-way; but, with a comparatively small sail area (only 100 square feet), such boats could hardly be expected to compete with the beamy Surbiton craft.

The main and mizen rig is found to answer well, and the boats stay well under it in smooth water. In rough water they require to be handled with more care in tacking; and if a boat seems likely to miss stays, the rowlock is close by the helmsman, and he can help her round with a stroke of an oar. However, generally they are backed round by hauling the foot of the mainsail to windward if they hang in stays; but the oar, if used, has this advantage—it keeps the boat going.

	ft.	in.
Mainsail, foot	10	0
Mainsail, head	10	0
Mainsail, luff	5	0
Mainsail, leech	14	6
Mainsail, tack to peak earing	14	8
Mainsail, clew to weather earing	10	9
Small mainsail, foot	6	6
Small mainsail, head	7	6
Small mainsail, luff	2	6
Small mainsail, tack to peak earing	9	0
Small mainsail, clew to weather earing	7	0
Mizen, foot	4	6
Mizen, head	2	6
Mizen, luff	2	4
Mizen, leech	6	0
Mizen, tack to peak earing	5	9
Mizen, clew to weather earing	4	9

It will be seen that the sails are not laced. The boom is fitted with goose neck or jaws to the mast, and the tack is bowsed down by a rope which leads through a block on the aft side of mast on the deck.

CHAPTER XVIII.

LAKE WINDERMERE YACHTS.

YACHT and boat sailing has been a favourite pastime on the Lakes from "time immemorial," but the men of thirty years ago would scarcely recognise the Windermere yachts of the present day. The designers of the present class of yachts, it is evident, thoroughly appreciate the value of a lead keel, and it is not unusual to find one of their yachts, which measures only 20ft. between stem and sternpost, with 4 tons of lead on her keel. Of course, with so much weight outside, it is not possible to carry much inside, as the displacement is kept as small as possible. The Windermere yachts are not, however, merely peculiar in the amount of outside lead they carry; they are, besides, most peculiar in form, as will be seen from the accompanying sketch of the Truant, owned by Mr. W. B. Forwood. It will be seen that the Truant (and all Windermere yachts are of the same pattern) has nearly the whole of her counter immersed, and this immersion of the counter has been the fashion upon Lake Windermere for a great number of years; so the plan could not possibly have been copied from Jullanar, as that craft was only designed three years ago.

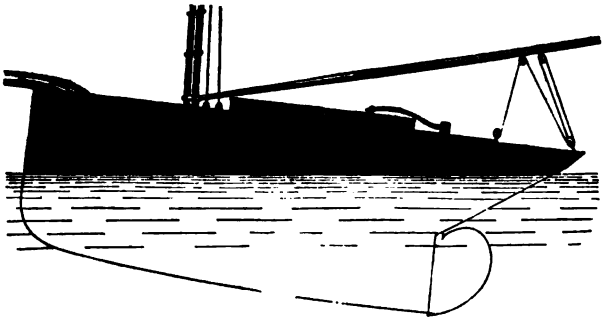


FIG. 66. THE TRUANT.

The fashion of immersing the counter, it appears, arose out of an intended evasion of the rule of measurement, which is simple length between stem and sternpost. So far, the intention was more successful than it was in the case of Jullanar, as she has been rated for length upon the water line. The Windermere club did not do this, but declared that the counters abaft the sternpost should not exceed 6ft. 6in. in length; and after this, if every yacht had not been been given an immersed counter, it would have been strange.

We imagine that the advantages of getting an excess of length by immersing the counter were discovered in this way: The Windermere craft more or less bore by the head, "shoulder," and consequently carry a very great deal of weather helm. Hence they were being continually trimmed by the stern, and always with some advantage; so it was not surprising that someone realised that an immersed counter is an advantage if length cannot be obtained in any other way without having to pay a penalty for it.

The Windermere yachts are mostly distinguished for their fine weatherly qualities, and it is believed by good judges that no other craft of similar length in the world are so good to windward as these little jammers. They are sailed with great boldness, of course; and there need be no fear of sailing them too hard, so far as danger is concerned, as, owing to the great weight they have on the keel, it would be impossible to capsize them.

These boats are the safest that could be built, as they are really uncapsizable; and if wholly decked in, no mishap need ever happen with them, further than the breaking of spars and bursting of gear. They can, moreover, be handled singlehanded, as there is very little gear to work: but the principal feature that should command the attention of the nervous is their almost absolute safety. Men are continually inquiring for a boat that will not capsize, or one that will not sink; but, whilst it is easy enough to make a small boat unsinkable, it is practically impossible to make one uncapsizable—we mean, of course, a 20ft. boat of the ordinary type. Now a small yacht built and ballasted like either of the designs we give would be uncapsizable, and it might easily be made unsinkable by having a water-tight bulkhead forward and aft. Of course, if carelessly sailed, such boats might get knocked down nearly on their beam ends, and, if the crew got scared, or were not careful where they had put their hands and feet, they might get a header; but the yacht, directly the pressure were removed, would right herself. Of course it would be nothing but the result of gross carelessness if a yacht did get knocked down on her beam ends; for, as Mr. Forwood rightly points out, in the case of squalls the boat should be luffed, and the jib sheet, if necessary, eased. It will not do to wait until the squall actually knocks the boat over; she must be eased with lee helm directly the first breath of the squall is felt. If the boat gets hove down and loses way, the power of luffing will be gone, and then, if water got into the mainsail, "righting" would be a slow process; and further, if water got into the hold, and if there were no water-tight compartments, the boat would sink. With such craft as these it is always the proper thing to do to ease the head sheets first, and not the aft sheets, as by easing the latter the power for luffing is reduced, and by easing the head sheets it is increased.

Mr. W. B. Forwood, owner of the Truant, writing upon the sailing qualities of these craft, says: "The Windermere yachts are rigged as sloops, with pole masts. We have found by experiment that they go to windward much faster with one large jib than with two smaller sails. This, I know, is contrary to the general opinion on the subject; but there is no doubt whatever that the yachts are closer-winded with one jib than they are with jib and foresail. When sailing on a wind the main sheet is hauled in as taut as it can be got, the boom forming the smallest possible angle with the keel. The helmsman steers by the luff of the jib, and, as the boats are very sensitive, they require most careful steering. Very heavy squalls are frequent, and they come down from the mountains without warning and with great fury. The boats are always sailed through these squalls, but are eased a trifle with the helm, so that they do not take the full weight of the wind; great care, however, is taken that they are not eased so much as to lose way. The squalls are generally "revolving," and if the boats were permitted to stop they would probably be taken next moment aback; so they are kept going to keep steerage way on, and follow the wind round. If a squall be very black and heavy, the jib sheet is eased a trifle, so as to luff quickly; but the main sheet is never in such cases started.

"It is astonishing what a weight of wind these boats will bear; they rarely sail without a topsail, and I never yet took a reef in my mainsail. They have 1ft. 6in. waterways, and 6in. coamings to cockpit; still, when very hard pressed, the water sometimes comes in over the coamings. The boats, however, are probably doing their best when only two or three inches of the deck are immersed. In sailing before the wind only fore-and-aft canvas is allowed, and no booming out permitted. As the boats have a tendency to bury their bows in running and reaching, all hands are put on the counter, until the taffrail is almost level with the water; and the more weight there is put on the counter under such circumstances, the better they seem to go. As the boats flare out a great deal above water at the foreside of the rigging (being so short and beamy), they 'shoulder' to leeward, and by trimming aft the shoulder is lifted out of the wave on the lee bow. On a wind the tendency of the boats is to lift their sterns and depress their bows, but 'shouldering' does not appear to such an extent."

It is quite clear that a yacht which requires so much weight shifted aft whilst she is moving must be wrong somewhere, and in the case of the Windermere craft we have not long to search for a cause of the defect. The midship section is placed only eight or nine feet abaft the fore side of the stem; and this fact, coupled with 8ft. beam, necessarily gives the yachts a very short and full bow. The bow is given a slight hollow at its extreme fore end; but this of itself is not an important relief, and the bow is essentially one that will bury itself, and be incapable of very high speed, excepting under a propelling power* out of all proportion to the size of the boat. The Windermere yachts have, as may be supposed, a comparatively long and fine after-body, and if they were driven stern first at a speed of nine knots the bow would still subside; only, under such conditions, it would form the stern of the vessel. Most American yachts, which have comparatively short after-bodies (generally the proportion of after-body to fore-body is as 4 to 5) subside by the stern at high speeds, and many English yachts which have long bows and comparatively short runs do the same—notably the cutters built by Fife do so. On the other hand, yachts of the cod's head and mackerel's tail type with short entrance and long run, bore by the head—that is to say, the hollow of the wave forward is so large that the bow sinks into it.

The depression by the bow is, no doubt, in the case of the Windermere yachts, much aggravated by the sail pressure; they have enormous sail areas (about 15 per cent. more than any five-tonner), and, as the head resistance they encounter at high speeds is very great, the depression due to the leverage of the sails alone must be very considerable (see page 26). Also the depression may be increased through inequalities in the wedges of immersion and emersion, and these latter influences will always have to be regulated by trimming. However, there is not much doubt that if the Windermere craft were propelled nine or ten knots an hour by steam, in an upright position, they would still "bore," on account of their midship section being placed so far forward. Still the forward position of the midship section need not be an unmixed evil; on a wind, when the speed is necessarily low, the shorter and fuller bow may be a positive advantage, and no doubt there is some reason for the old saying "A full bow eats itself to windward." However true this may be, so far as the ardency of the pressure on the lee bow assisting the boat to windward is concerned, there is now no room for doubting that a long entrance (of course of the proper form) is better for sailing on any point than a short entrance.

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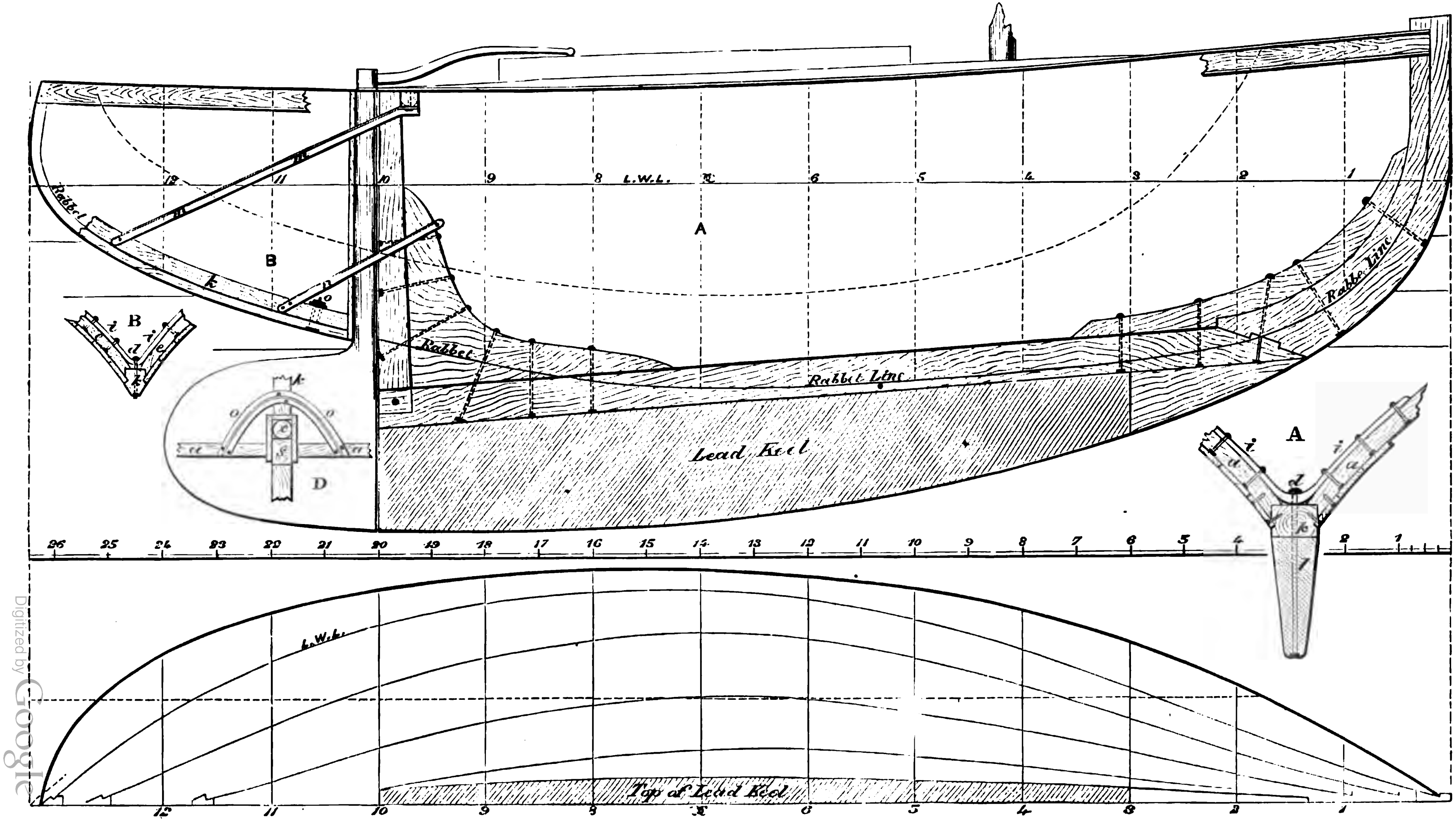
* With a good strong and pretty steady breeze, the yachts have thrashed to windward six miles (equal to eight and a half miles), run seven, and reached eight in 3 hours 35 minutes; this would give a mean speed of nearly seven knots per hour, which must be considered exceedingly good.

PLATE XV.



Lake Windermere Yacht, length 26ft. 6in.

As the immersion of the counter is countenanced by the Windermere club, there is no reason why it should not be treated as an integral part of the vessel, as it was in the Jullanar. But, strangely enough, most of the Windermere craft are designed as if they were to be only 20ft. on the load line, with the counter clear of the water at the stern post, the counter being subsequently immersed according to the trim required in sailing. It is true the Mischief was designed last year on the Jullanar plan; but the mid-section was kept very far forward, and, moreover, the bow was exceedingly full, without any hollow at the entrance. Mr. J. Harvey, of Wivenhoe, has designed a craft with the mid-section some distance abaft the centre of length of the load line, and generally the design, excepting in the matter of beam, is like that of Jullanar. In the design, Plate XV., the whole length (26ft. 6in.) allowed by the club rule has been appropriated, and the midship section was placed, as it would be in any ordinary yacht of similar length, a little abaft the middle of length of the load line. The bow is consequently about 4ft. longer than the usual length of bow of a Windermere yacht, and the stern is shorter but not so much as the bow is longer, because the whole length (excepting a couple of inches) has been taken for the permanently immersed length.

Most of the Windermere yachts show a little less bilge, and are fuller near the garboards, than the designs (Plates XV. and XVI.); but all, we believe, have the greatest beam at the deck. Mr. Harvey's design has the greatest beam near the load water-line, and aft on deck is nearly as sharp as forward. The bow frames are very straight, and she shows a pretty straight line of immersion.

The No. 1 design (Plate XV.) has 8ft. 9in. beam, and would show a hollow line of immersion at 20° heel; but the No. 3 design is very clean on the line of immersion at that inclination.

No. 1 design is possibly of too great displacement to compete with success on Lake Windermere, and would be more suitable for coast sailing, where beaching is not necessary.

No. 2 design (Plate XVI.) has less displacement, and ought to be able to successfully compete with the Windermere yachts.

No. 3 design (Plate XVI.) is of still lighter displacement, and generally (excepting in the form of bow and position of the midship section) is more like the Windermere yachts. The centre of buoyancy is a little farther forward than in either of the other designs; still the entrance is very much longer and finer than that of any Windermere yacht, and the after-body, for mere fineness, closely resembles the after-body of such a yacht.

As to the capabilities of the designs for competition against the Windermere craft, No. 3 would probably turn out the most successful. So far as theoretic principles go, either design ought to be capable of beating the Lake craft, if the handling were equal; and if No. 3 did not succeed, because her bow is too long and her stern too short, we should have to begin to study the subject afresh, and all the knowledge acquired during the last thirty years in the way of naval science may be regarded, so far as the requirements of Lake Windermere are concerned, as utterly useless.

The topsail shown is not so large as the American sloops of similar size carry. The usual shape of an American topsail is shown in Fig. 33 (page 119). It will be seen that the yard is "up and down the mast and the foot, laced to a jack yard, extends far beyond the head of the main sail. This sail is known in America as a club topsail, but it can be only carried in light winds, and is not adapted for squally weather.

The sails of the yachts are made of duck, and are admirably contrived for flatness by the local sailmaker. The sloop rig, it has been proved by experience, is much the best for going to windward, and on the lake no difficulty is ever experienced in handling it.

The sail plan is shown in the sketch (Plate XVII.), and it will be seen that the gear is very simple, all running through single blocks. The main halyard block is not shown in the sail plan. The upper block is hooked to an eye in the main rigging iron, about 1ft. 6in. above the jaws of the gaff. The standing part of the halyard is fast to the upper block; the other end is passed through a block on the jaws, then through the upper block.

The hulls are pumice-stoned outside, and then black-leaded, very great attention being paid to the condition of smoothness of the bottom.

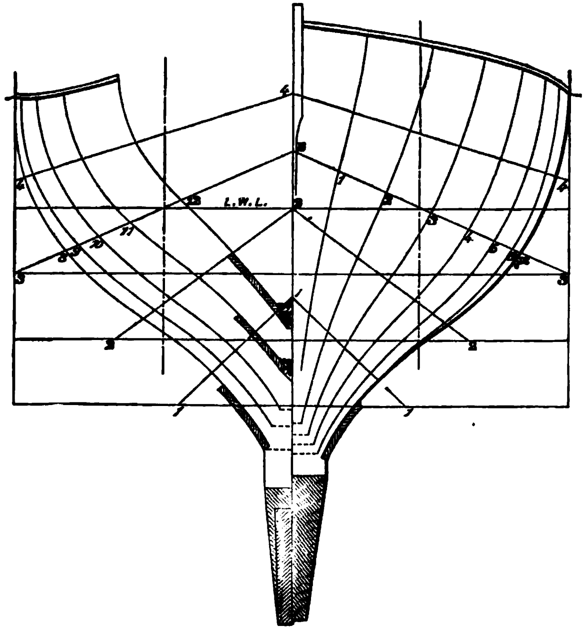
LAYING-OF TABLES.

No. 1. Design.

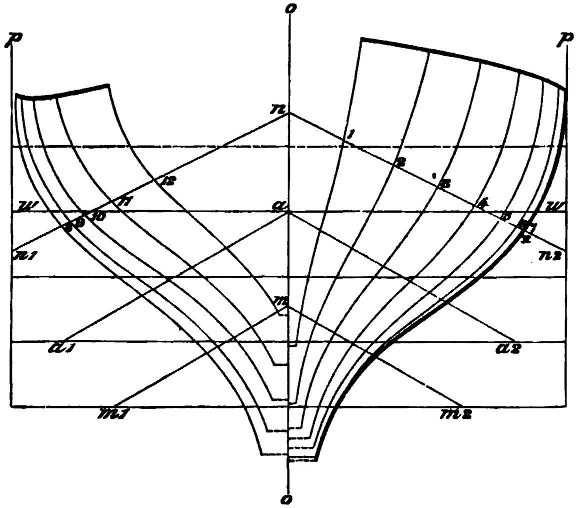
No. of Sections.	1	2	3	4	5	6	7	8	9	10	11	12
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to deck..	2 7	2 5	2 3	2 1	1 11½	1 10½	1 9½	1 9½	1 9	1 9½	1 9½	1 10½
Depths below L.W.L. to rabbet of keel	2 0½	2 11	3 3	3 5½	3 7	3 8½	3 9½	3 8	3 4	2 11	2 4½	1 7
Depths to under side of keel ...	—	3 3½	—	—	—	—	—	—	—	4 6	—	—
Depths of lead keel	—	0 *6½	1 2	1 6½	1 10½	2 1	2 2	2 1½	2 0½	1 10½	—	—
Half-breadths on deck	1 1½	2 1½	2 11½	3 6½	3 11½	4 2½	4 3½	4 3	4 2	3 11	3 6	2 8½
Half-breadths on L.W.L.	0 7½	1 4	2 1½	2 10	3 4½	3 9	3 10½	3 10	3 7½	3 3	2 7½	1 7
Half-breadths, No. 2 W.L.	0 4	0 10½	1 6½	2 2½	2 8½	3 1	3 2½	3 0½	2 8½	2 2	1 5½	0 7
Half-breadths, No. 3 W.L.	0 1½	0 5½	0 11	1 4	1 8½	1 11½	1 11½	1 10	1 6½	1 0½	0 5	—
Half-breadths, No. 4 W.L.	—	0 2	0 4½	0 7½	0 10	0 11½	0 11½	0 9½	0 6½	0 2½	—	—
Half-breadths on diagonals, 1 ...	0 3½	0 8½	1 1½	1 5	1 7½	1 9	1 9½	1 8½	1 6	1 2½	0 9½	0 3
Half-breadths on diagonals, 2 ...	0 7½	1 2½	1 10	2 3½	2 7½	2 10½	2 11	2 9½	2 7	2 2½	1 9½	1 1½
Half-breadths on diagonals, 3 ...	0 9	1 6½	2 3½	2 10½	3 4½	3 8	3 9½	3 8½	3 5½	3 1½	2 7½	1 9½
Half-breadths on diagonals, 4 ...	0 11½	1 10½	2 8	3 3½	3 9½	4 1½	4 3	4 2½	4 1½	3 9½	3 3½	2 5½

* This depth refers to the filling up piece of wood forward of lead keel, and forming fore foot.

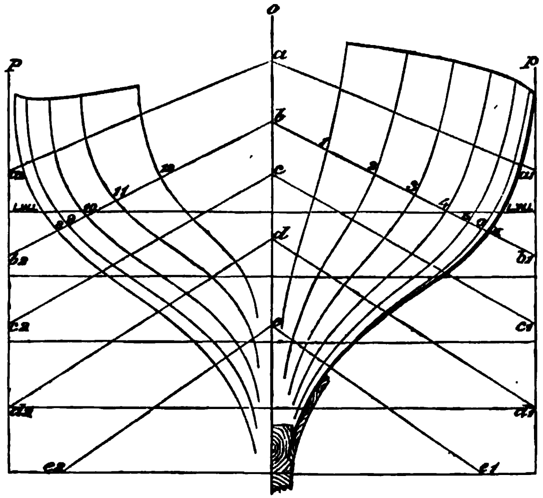
PLATE XVI.



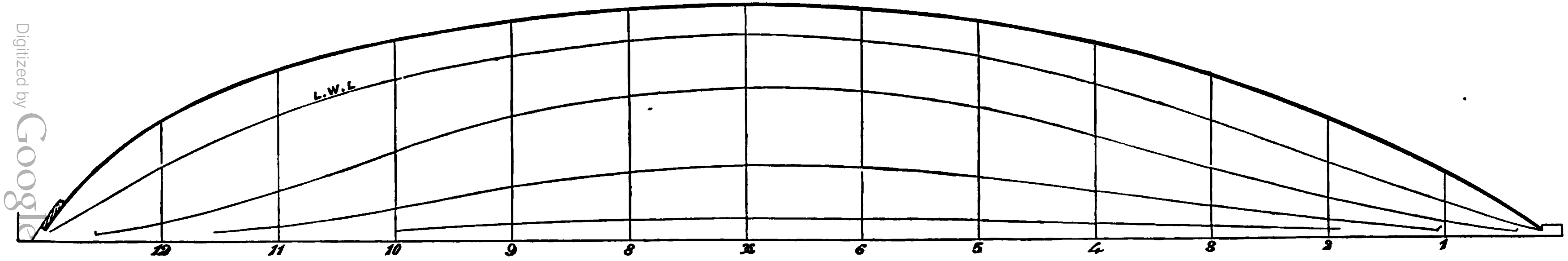
Design No. 1.



Design No. 2.



Design No. 3.



Design No 3.
Windermere Yachts.

No. 1 diagonal radiates from the middle vertical line of the body plan at 1ft. 4in. below L.W.L., and cuts the lower water line at 1ft. 8½in. from the middle line. No. 2 diagonal radiates from the L.W.L., and cuts the third water line at 2ft. 9½in. from the middle line. No. 3 diagonal radiates from the middle line at 10in. above the L.W.L. No. 4 diagonal radiates from the middle line at 1ft. 9in. above L.W.L., and cuts the side perpendicular 5in. above L.W.L.

No. 2. Design.

No. of Sections.	1		2		3		4		5		6		7		8		9		10		11		12	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
Half-breadths on deck	1	1¼	2	1	2	11	3	6	3	11	4	2	4	3½	4	3	4	2	3	11	3	6	2	8
Half-breadths 1ft. above L.W.L.	0	9	1	7½	2	6	3	2½	3	8¼	4	0	4	1¾	4	1¼	3	11½	3	8½	3	3	2	5
Half-breadths on L.W.L.	0	6	1	2¼	2	0½	2	9	3	8½	3	7½	3	9	3	8¼	3	6	3	1	2	5	1	6
Half-breadths, No. 2 W.L.	0	3	0	8½	1	8½	1	10½	2	4½	2	9	2	10½	2	9	2	4½	1	10	1	2½	0	5½
Half-breadths, No. 3 W.L.	0	2	0	8½	0	8	1	0½	1	4	1	6	1	6½	1	5	1	2	0	9	0	4	—	
Half-breadths, No. 4 W.L.	—		0	2½	0	8¼	0	5½	0	7½	0	8¼	0	9	0	7½	0	5	0	2½	—		—	
Half-breadths, diagonal (*n*)	0	10	1	8½	2	5¼	3	1½	3	7	3	10½	4	0	3	11	3	9	3	5½	2	11¼	2	3
Half-breadths, diagonal (*a*)	0	6	1	1	1	7½	2	1	2	5½	2	8¼	2	9	2	7½	2	5	2	1	1	8	1	0
Half-breadths, diagonal (*m*)......	0	2	0	5½	0	9½	1	1½	1	4¼	1	5½	1	6¾	1	5½	1	3	0	11½	0	7	0	2

n diagonal is struck 1ft. 6in. above the L.W.L., and cuts the perpendiculars *p p*, at *n* 1 and *n* 2, 7½in. below the L.W.L.

a diagonal cuts No. 3 water line, at *a* 1 and *a* 2, 8in. from the perpendiculars *p p*.

m diagonal is struck 1ft. 5in. below the L.W.L., and cuts No. 4 water line, at *m* 1 and *m* 2 1 ft. 6in. from the perpendiculars *p p*. All the water (horizontal) lines shown in the body plan are 1ft. apart.

No. 3. Design.

No. of Sections.	1		2		3		4		5		6		7		8		9		10		11		12	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
Depths below L.W. to rabbet...	—		2	8	3	0	3	3	3	5½	3	7½	3	8½	3	7½	3	4	2	11	2	4	1	7
Depths to under side of wood keel	—		3	1	—		—		—		—		—		—		—		4	6	—		—	
Half-breadths on deck	1	1½	2	0½	2	9	3	3½	3	8½	3	11	4	0	3	11	3	8½	3	5	2	11	2	1
Half-breadths on L.W.L.	0	6½	1	3	1	11½	2	7½	3	1½	3	4½	3	6	3	5	3	2½	2	9½	2	1¼	1	3
Half-breadths on *a* diagonal......	1	1	2	0	2	8½	3	4	3	9	4	0	4	1½	4	0½	3	11½	3	7	3	1	2	2
Half-breadths on *b* diagonal......	0	11	1	8½	2	4½	2	11½	3	4¼	3	7	3	8¼	3	7	3	5	3	1	2	7½	1	10
Half-breadths on *c* diagonal......	0	8½	1	4¼	1	11½	2	5	2	9½	3	0	3	0¼	2	11¼	2	9	2	4½	1	11½	1	4
Half-breadths on *d* diagonal......	0	5	0	10	1	3	1	8	1	11	2	1	2	1½	2	1	1	10	1	6	1	0½	0	7
Half-breadths on *e* diagonal......	0	1¼	0	4½	0	7	0	9½	0	11½	1	0	1	0½	1	0	0	10	0	7	0	4	0	0

a diagonal is struck 2ft. 3½in. above the L.W.L., and cuts the side perpendiculars on the body plan at *a* 1 and *a* 2, at 7¼in. above the L.W.L.

b diagonal is struck 1ft. 4in. above the L.W.L., and cuts the side perpendiculars at *b* 1 and *b* 2, at 8in. below the L.W.L.

c diagonal is struck 7in. above the L.W.L., and at *c* 1 and *c* 2 cuts the side perpendiculars 1ft. 8½in. below the L.W.L.

d diagonal is struck 5in. below the L.W.L., and cuts the side perpendiculars at the intersection of the same with the 4th water line.

e diagonal is struck 1ft. 9in. below the L.W.L., and at *e* 1 and *e* 2 is 3ft. 2½in. from the middle ver.ical line *o*.

WINDERMERE (No. 3 DESIGN).

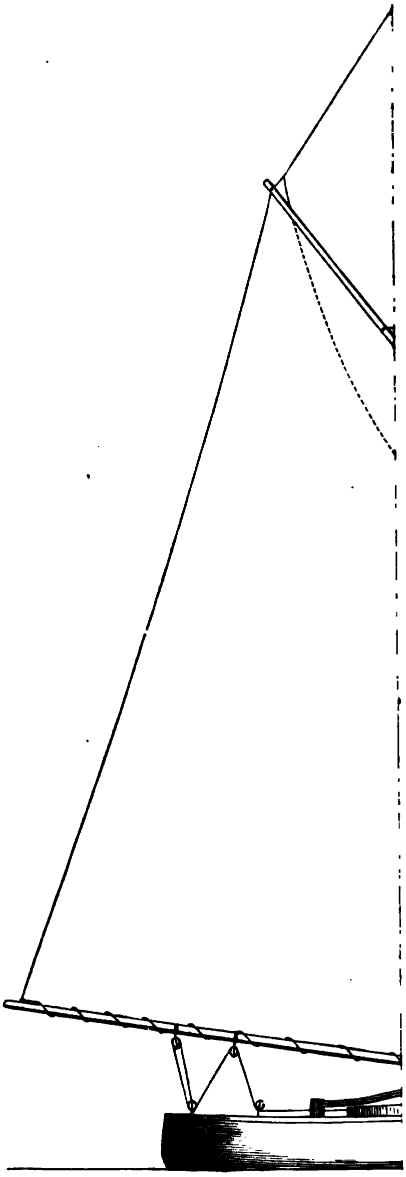
HULL.	1	2	3
Length, extreme	26ft. 6in.	26ft. 6in.	26ft. 6in.
Length between stem and sternpost	20ft. 0in.	20ft. 0in.	20ft. 0in.
Greatest beam, moulded	8ft. 6in.	8ft. 6in.	8ft. 0in.
Beam on L.W.L. moulded	7ft. 8in.	7ft. 6½in.	7ft. 0in.
Draught of water aft at sternpost	6ft. 5in.	6ft. 5in.	6ft. 5in.
Displacement	7·2 tons.	6·4 tons.	5·7 tons.
Area of midship section	17·5 sq.ft.	16·3 sq. ft.	14 sq. ft.
Midship section aft centre of length of L.W.L.	0·8ft.	0·8ft.	0·8ft.
Centre of buoyancy aft centre of L.W.L.	0·5ft.	0·5ft.	0·2ft.
Metacentre above C.B.	0·7ft.	0·73ft.	0·85ft.
Centre of lateral resistance aft centre of L.W.L.	0·0ft.	0·0ft.	0·05ft.
Centre of effort of sails ahead of C.L.	0·8ft.	0·8ft.	1ft.
Weight of lead keel	4 tons.	3½ tons.	3 tons.
SPARS AND SAILS.			
Mast, deck to topsail halyard sheave	38ft. 6in.	38ft. 6in.	34ft. 5in.
Bowsprit, outside of stem	17ft. 0in.	17ft. 0in.	16ft 0in.
Main boom, extreme	25ft. 0in.	25ft. 0in.	24ft. 0in.
Gaff, extreme	21ft. 6in.	21ft. 6in.	21ft. 6in.
Topsail yard	25ft. 0in.	25ft. 0in.	22ft. 0in.
Foot of mainsail	24ft. 3in.	24ft. 3in.	23ft. 6in.
Head of mainsail	21ft. 0in.	21ft. 0in.	21ft. 0in.
Luff of mainsail	21ft. 0in.	21ft. 0in.	19ft. 0in.
Leech of mainsail	36ft. 0in.	36ft. 0in.	32ft. 9in.
Tack to peak earing	40ft. 0in.	40ft. 0in.	37ft. 6in.
Clew to throat	29ft. 8in.	29ft. 8in.	27ft. 0in.
Foot of foresail	23ft. 0in.	23ft. 0in.	22ft. 0in.
Luff of foresail	35ft. 0in.	35ft. 0in.	34ft. 0in.
Leech of foresail	27ft. 6in.	27ft. 6in.	25ft. 0in.
Mainsail area	574 sq. ft.	574 sq. ft.	440 sq. ft.
Foresail area	317 sq. ft.	317 sq. ft.	272 sq. ft.
Total area	819 sq. ft.	891 sq. ft.	712 sq. ft.

The sections are 2ft. apart, and No. 2 section is 2ft. from the fore side of the stem.

The water-lines are 1ft. apart. The timbers numbered at 1, 2, 3, 4 on the sheer plan will be sawn 2in. sided, moulded 3in. at heels, and tapering to 1¾in. at heads. A steamed timber 1½in. square between each pair of sawn timbers.

Stem 3½in. sided; 3½in. moulded at head; 1ft. 2in. at scarph with keel. Keel 11in. sided amidships, tapering to 3½in. at its fore end, and 4in. at its after end. Uniform depth of keel 8in.

PLATE XVII.



S

The keel of No. 3 design will be 8in. sided amidships, tapering at ends as in No. 1.

The under side of the keel at No. 2 section for No. 1 and No. 2 designs is 3ft. 3½in. below the L.W.L.; the underside of the keel at the sternpost is 4ft. 6½in. below the L.W.L.

The draft forward of No. 3 design is less than the others. The depth to under-side of keel fore and aft will be found in the table for No. 3 design. In other respects the sheer plan accords with each design.

The sternpost is 4in. sided, and 7in. moulded at the heel, where it is tenoned into the keel.

Plank ⅞in. Top strake 1in.

The general plan of floor construction is shown by figure A., which represents the mid-section; this plan will extend from No. 3 station forward to the sternpost. *a a* are the timbers or frames joggled on to the keel as shown; *k* is the keel; *l* lead keel; *i* stout iron knee floors; *d* head of a yellow metal bolt passing through iron floor, keel and lead keel.

Figure B shows the floor construction of section 11 beyond the sternpost; *k* is the counter keel and *a a* are frames joggled on to it as the frames are to the main keel; *i* is an iron floor knee bolted through the counter keel at *d*.

The rigidity of the counter aft will be maintained by angle iron stays, arranged something in the manner adopted in the construction of Jullanar. The counter keel, *k*, is 4½in. sided and 5in. deep; *m* is a stay of ∟ iron or ⊥ iron bolted to the counter keel and to a deck beam; there are two such stays as these, and from the counter keel they gradually spread out until where they are bolted to the deck beam they are 3ft. apart. Two other similar stays as *n* (shown) are fixed to the lower end of the keel, and held together at the back of the deadwood at the sternpost by a bolt. To ensure the keel and counter frame against being forced away from the sternpost a kind of yoke made of ⊥ iron is bolted to the keel and brought round each side of the sternpost, where the ends are bolted to the timbers or frames that abut therefrom. The stretch D shows this yoke *o* bolted to the keel *k* and frames *a a*. The sternpost is shown by *s*, and the rudder post and trunk by *x*. In the sheer plan a section of the ⊥ iron yoke is shown at *o*.

CHAPTER XIX.

ITCHEN BOATS.

The boats of the Itchen Ferry fisherman have a very high reputation in the Solent, and no doubt they are of a superior model to many coast fishing craft. For many years match sailing amongst them has been an annual occurrence, and probably the contests on these occasions, combined with the true racing spirit which animates all the Itchen-Ferry-men, have tended to produce and maintain a model adapted for speed; and the nature of the work the boats are put to has happily prevented their sterling qualities as hard weather craft being in any way sacrificed to the exigences of competitive sailing. The fact is, that the Itchen boats have always been distinguished for their excellence from a match sailing point of view, and as before said, the few annual contests have only served to keep that excellence from diminishing. The standard of value for competitive sailing, we believe, has always been simple length, and if the theoretical tendencies of such a rule is generally to produce mere skimming dishes, it has hitherto had no such effect on the Itchen boats. Of late years too, gentlemen fond of racing small craft, have built boats on the Itchen model, and these, although still competing under the "length rule," do not grow more beamy and shallow, but on the contrary (owing to considerations hereafter to be referred to) show signs of becoming less broad in the beam and deeper. The designs which we give represent these modern racing craft more than the fishing boats, but in a general way the hulls of both fishing and racing craft agree in model.

The design for the 30ft. boat, or 10-tonner (Plate XVIII.), was made for a boat of 27ft. length by Mr. Shergold, a well-known draughtsman of Southampton; the design was got out for Mr. T. G. Freke, to compete in the 27ft. class of which Rayonette is such an ornament, but he ultimately decided to build Freda instead. The design has not been altered in any way, but a scale was made to correspond with a length on deck of 30ft. 4in.

This gave a beam of 9ft. 6in. and a tonnage of $9\frac{82}{94}$ tons, or practically 10 tons.

The Rayonette, we might here say, was lengthened in the spring of 1877, and is now 29ft. 9in. long on deck, but her beam is only what it was when her length was 27ft., that is 9ft. The 30ft. design we give, has thus 6in. advantage in beam, 7in. in length, and is exactly 1-ton larger. There is no doubt that 6in. of beam is a very great advantage, so far as these boats are concerned, when they compete generally by length; so also in sailing under the Y.R.A rule, in the case of two boats of such proportions as 29·7 × 9 and 30·3 × 9·5, we should expect to find the 6in. excess beam of more value than the time for 1 ton that would have to be conceded. However, the owner of Rayonette (Mr. H. Little), assures us that Rayonette is wonderfully stiff under canvas, and indeed would very well bear more. She has 1ft. less length of mast, 1ft. less boom, and 9in. less gaff than given in the table; she has 8cwt.* less weight of lead keel; but her total weight of ballast corresponds with that given in the table.

The Rayonette was altered by Dummer, her builder, as her owner wished to compete in the 30ft. class on Southampton Water, and at Swanage, and she may now be regarded as the best boat of that class afloat. She, too, has very fairly figured in the ten-tons class, and in a good breeze is a match for most of the 10-tonners to windward, but fails in running and reaching, as an ordinary 10-tonner has about 9ft. more length. 30ft. is now the fashionable length for a 5-tonner, and when a 10-tonner has only 30ft. in length, it may be assumed that there is a wide difference in the proportion of breadth to length, and that consequently the results of encounters on different points of sailing between a 10-tonner like Rayonette, 30ft. long, and one like Florence, 39ft. 9in. long, would very much vary. For instance, in a match of the Prince of Wales Yacht Club sailed in June, 1877, in a good strong breeze, between Rayonette (9-tons), Lily (10-tons), Mildred (10-tons), Zephyr (10-tons), Alouette (5-tons); the Rayonette was the absolutely last reaching down the river to Southend; being 12 minutes astern of Lily, which was leading. In the thrash back, with housed topmast, Rayonette passed all but Lily, and gained 4 minutes on that craft. This probably may be taken as a good example of what a boat like Rayonette can do,† and it is evident that what she loses in running and reaching, cannot be made up by what she might gain in beating, if her competitors happened to be any of the crack 10-tonners. Whether an addition of 6in. to the beam, such as given in the design now published, would improve such craft so as to enable them to compete successfully with the best of the 10-tonners is an open question, but at any rate, the extra 9ft. of length will always keep a good 10-tonner ahead when sailing off the wind.

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* Probably the lead shown in the 30ft. design, should be reduced in length aft by 4ft.

† It also, we believe, bears out the experience on the Mersey when the Wonderful sailed against the 10-tonners there.

Of course for sailing in the 30ft. class, the 6in. extra beam is certain to tell, supposing all other things to be equal.

It will be noted that the length of the design given in the table is 30ft. 4in.; the odd inches would disqualify the boat for the 30ft. class, and in building it would be necessary to bring the stern post upright from the keel, so that the length on the deck line did not exceed the 30ft. limit.

The 30ft. design and the 27ft. design being identical, we need make no remark about it, further than say that Mr. Shergold in making it, was fully impressed with the desire that she was to beat the whole 27ft. class.

The 25ft. (Plate XIX.) boat was designed by Mr. Shergold for Mr. Fay, who successfully raced her under the name of Salus; she was bought in 1871 by Mr. Beavor Webb, who renamed her Israfel. She won ten prizes out of twelve starts whilst in Mr. Webb's hands, and he sold her to Mr. H. Little, who has raced her with varied success under the name of Wild Rose. As the 25ft. class is now done away with, Wild Rose has to sail with the 27ft. boats, and receive time.

The 21ft. (Plate XX.) design represents that of the Centipede, the most successful fishing boat ever turned out by Mr. D. Hatcher. In the drawing, the design is represented as for a boat of 22ft. 8in. length, but all the sections are exactly as they were in the 21ft. boat, the *spacing* between the sections only having been increased, so as to bring the length up to that necessary to make 5 tons with the same 8ft. beam. The water-lines, with the extra spacing as shown, certainly look very much better, even than they did in the 21ft. design, and no doubt a boat of the extra length would be a very fast and capable craft; and, moreover, would be eligible for the 23ft. class. The Centipede, we might say, had very much less weight in her iron keel than given in the table, and the siding of her wood keel was less: the siding of the keel has been increased solely with the object of getting more lead underneath it.

The Itchen boats are always carvel built; and are usually decked forward, with a stern sheet aft, and are open amidships with a water way and coaming round. The floor construction is variously contrived, but the most approved plans are those shown in the designs for the 30ft. and 23ft. boat respectively. In the 30ft. design, a hogging piece, or keelson, of wood, iron, or lead, is worked upon top, the main keel of about half the siding of the latter. A sectional view of this construction is shown at midship section. It will be seen that the heels of the timbers rest on the top of the main keel, and are spiked to the keelson. The whole is secured by iron floor knees bolted, as shown. The spaces between the plank floor and keelson, are filled with concrete made with cement and boiler punchings, or cement and lead shot. This is smoothed off level with the top of keelson. Aft a stepping line to take the heels of the timbers has to be cut in the dead wood; in the middle length, the top of the main keel as shown, forms the stepping line.

In the 21ft. design (Plate XX.), no keelson is worked. A stepping line is set off on the keel and dead woods, as shown by *s*. At each station for a frame, a joggle is cut in the keel and dead wood, *b b*, for the heel of the frame to be step-butted in, as at *a*, *a*, *a*. A sectional view of this fitting is shown by A. The heels of the frames are bolted through the keel, and the whole is secured by iron floor knees. This plan is to be preferred, unless the keelson is of metal, on account of it having an advantage for ballasting. Any spaces left between the sides of the keel and the plank should be filled with concrete, made as before described. The rabbet (*r*) will be cut as shown, and the garboard strake should be fastened with as long spikes as practicable.

All the Itchen boats have, we believe, what is known as "raking midship sections;" that is, the broadest width of each succeeding water-line is progressively farther forward from the load water-line downwards. This peculiarity is most apparent in the Centipede. It will be seen that her greatest beam on the L.W.L. is very far aft of the greatest breadth of the lower water-line. The introduction of lead keels and the reduction in the proportion of beam to length, will perhaps cause the rake given to the midship section to be somewhat modified in future, and its advantage under any conditions is at least a debateable point. With regard to the proportion of beam to length there is evidence that the proportion is gradually getting less; there is no doubt that the lead keels and lead ballast are at the bottom of this, perhaps assisted by an apprehension that at some time or the other the boats will have to compete under the "tonnage" rule. However, the fisherman still patronise beam, without any such apprehensions, and one of the most successful boats in their class has 9ft. breadth to 21ft. length.*

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* There is not much doubt that a heavy lead keel (and a little less beam if thought desirable) is safer than so very much beam and very little outside weight. The fishing boats, as a rule, have very little siding to their keels, and the weight of iron that can be got underneath is consequently very small. It is generally thought, however, among the fishermen, that a foot or so extra beam will more than compensate for the absence of a ton or so weight on the keel. There is a very great mistake about this, and the beamiest of the Itchen boats, as they are necessarily the shallowest, and have, moreover, little or no weight outside and loose ballast inside, are by far the most unsafe, as, although very stiff at first, they lose their righting power as they get near their beam ends (see page 37). Only recently one of the beamiest of the Itchen boats (19ft. by 9ft.) was capsized in a squall through the loose ballast shifting, and a beamy Itchen boat with no great weight on her keel requires as much looking after in a squall as a Una.

Until the last four or five years an Itchen boat was never seen with a counter; now counters are becoming common, but, as the regular Itchen boats are square sterned, we have so represented them in the designs. A counter would of course give them a more finished appearance, and would help hold the boats a little if much pressed. They however make very little back water wash off the lee quarter, as the transom is so high set. With a counter, the buttock lines would be dropped a little at the transom, according to the length of overhang. The transom would have to be a little wider, too, as otherwise the counter would be very narrow at the arch board.

In rig the Itchen boats have undergone very marked changes. A quarter of a century ago a bowsprit or a bumpkin was quite an innovation; the common rig being foresail with tack fast to stem head, and sheet working on a horse; mainsail without boom, with sheet working on a horse, and very frequently a mizen was added. The mast was long, and the gaff short, and the rig was generally commended because all the sail was in board. However, it would seem that the boats were lacking in head canvas, as "bumpkins" were introduced somewhere about 1851. In an account of a match sailed in 1852, published in *Bell's Life* of that year, we read—

"The latest and best boats have very sharp bows, with a full midship section, a hollow floor, and square stern: the dimensions for one adapted for a single hand are, length 18ft. 6in., breadth 7ft. 8in. The stem and stern post are perpendicular, with the fore foot slightly rounded off. The height out of water is 1ft. 9in. Some of them have heavy cast iron keels weighing from 2cwt. to 3cwt. The foresail is now set on a bumpkin instead of terminating at the stem head. The dimensions for the sails of a boat of the length given are: hoist of mainsail 17ft. 6in.; boom 13ft.; gaff 10ft.; bumpkin 3ft. 6in.; a bowsprit is also carried."

Excepting the length of boom and gaff, these dimensions are pretty much the same as would be given to a similar craft at the present time; in fact the long mast is retained, and the boom and gaff is very much increased in length.

All the Itchen boats still have the bumpkin,* which is a small iron bar (see A, Plate XXI.) fitted to the stem head as shown at *d*; the bumpkin has an iron stay (*s*) welded to it, and bolted to the stem at *k*. The forestay is set up to the bumpkin by a lanyard as shown at *m*. The boats have two shrouds a-side, a pendant and runner, topping lift, topmasts, backstays, preventers, and all the rest of the usual yacht gear, including, of course, purchases.

The dimensions for the sails given are large, and intended for a

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* The Bayonette we believe is the only boat without one, and her's was only discarded when she was lengthened in 1877.

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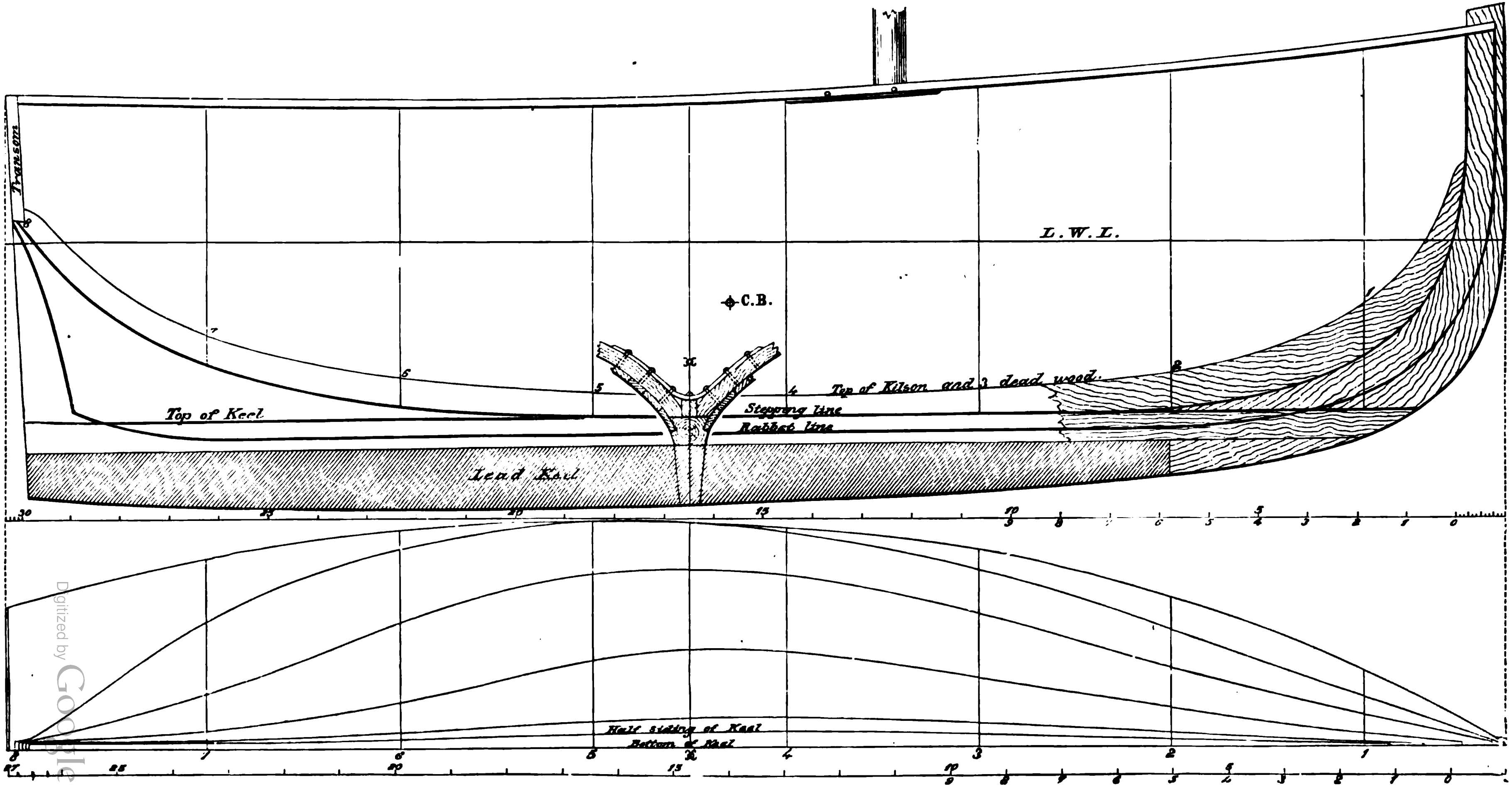
PLATE XVIII.



Itchen Boats of 30ft. 4in. and 27ft. in length.

racing outfit. For a "fisherman's" outfit the mast would be reduced in length about one-ninth, and the boom and gaff about one-seventh. Compared by length and breadth of water line, the sail areas are about equal to those of the Windermere yachts, but probably one of the latter would be more than a match for any boat on Southampton Water.

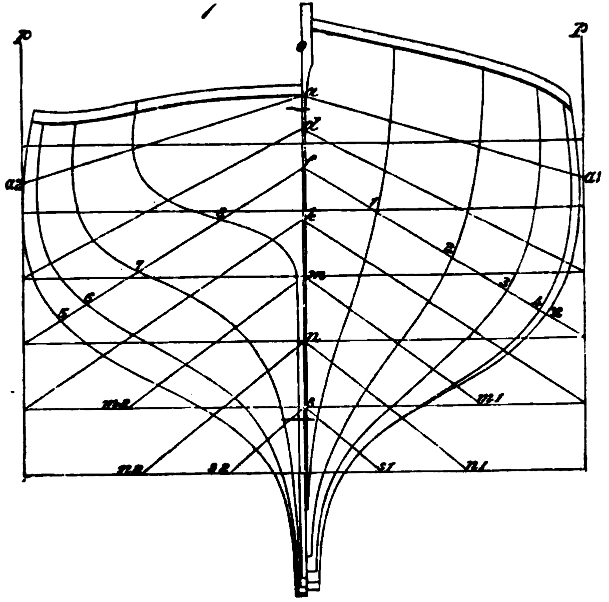


FIG. 67.

LAYING-OFF TABLE FOR 30FT. 4IN. BOAT (SEE PLATE XVIII. AND FIG. 67.)

No. of Section	1	2	3	4	M	5	6	7	8
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of timbers	3 10	3 5	3 1	2 10	2 9	2 9	2 8	2 8½	2 9½
Depths below L.W.L. to stepping line	2 3	3 4	3 7	3 7	3 7	3 7	3 4	2 6	—
Depths below L.W.L. to underside of keel	4 0	—	—	—	—	—	—	—	4 3
Half-breadths at gunwale	1 5	2 11	3 11	4 5¾	4 6½	4 6	4 3	3 9	2 9½
Half-breadths on L.W.L.	0 10½	2 2½	3 5¾	4 3	4 5¾	4 5½	—	—	—
Half-breadths on diagonal *a*	1 4½	2 11½	4 0½	4 8	4 9¾	4 9½	4 7	3 11½	2 10¾
Half-breadths on diagonal *d*	1 4½	2 11½	4 1½	4 10¾	5 0¾	5 0½	4 8	3 9¾	2 5
Half-breadths on diagonal *f*	1 3½	2 9½	3 11	4 7	4 9	4 8¾	4 2	3 1½	1 6
Half-breadths on diagonal *k*	1 1	2 4	3 4½	3 10½	4 0	3 11½	3 4½	2 3¼	6 0
Half-breadths on diagonal *m*	0 10	1 9½	2 6¾	2 11½	3 0	2 11	2 4¾	1 4¾	0 1¾
Half-breadths on diagonal *n*	0 5	1 1½	1 9	1 11¼	1 11½	1 10½	1 5	0 8½	0 1¾
Half-breadths on diagonal *s*	0 1½	0 6½	0 11¼	1 0½	1 0½	1 0	0 8	0 3	0 1¾

No. 1 section is 3ft. from the extreme fore side of stem. All the other sections are 3ft. 11in. apart, but the aft side of the transom is only 3ft. 10in. abaft No. 7 section. The midship section is midway between No. 4 and No. 5 section.

The water lines are 1ft. 1¼in. apart.

Diagonal *a* is struck 3ft. above the L.W.L., and at *a* 1 and *a* 2 cuts the perpendiculars *p p* 1ft. 8in. above the L.W.L.

Diagonal *d* is struck 2ft. 6in. above the L.W.L.

Diagonal *f* is struck 1ft. 10in. above the L.W.L.

Diagonal *k* is struck 11½in. above the L.W.L.

Diagonal *m*, at *m* 1 and *m* 2, is 2ft. 11in. from the middle vertical line *o*.

Diagonal *n*, at *n* 1 and *n* 2, is 2ft. 9in. from the middle vertical line *o*.

Diagonal *s*, at *s* 1 and *s* 2, is 1ft. 2in. from the middle vertical line *o*.

All the half-breadths are *without* the plank; but in the drawing the boat is represented with the plank on.

The lead keel will be 23ft. 6in. long, 9in. deep at its fore end, 1ft. 3in. amidships, and 11in. aft.

The breadth of the keel on the top at its fore end will be 4in.; amidships, 7in.; aft, 4in.; uniform breadth of the under side, 3in.

LAYING-OFF TABLE FOR 27FT. BOAT (SEE PLATE XVIII. AND FIG. 67).

No. of Section	1	2	3	4	⊗	5	6	7	8
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights to top of timbers above L.W.L.	3 5	3 0½	2 8¾	2 6	2 5½	2 4¾	2 4	2 4½	2 6
Depths below L.W.L. to stepping line	2 1	3 0	3 2	3 2	3 2	3 2	3 0	2 3	—
Depths below L.W.L. to under side of wood keel	3 7	—	—	—	—	—	—	—	3 10
Half-breadths at gunwale	1 3	2 7	3 6	4 0	4 0½	4 0	3 10	3 4	2 5
Half-breadths on L.W.L	0 9	1 11¾	3 1½	3 9¼	4 0	3 11¾	3 6	—	—
Half-breadths on diagonal *a*	1 3	2 7½	3 7½	4 1½	4 3	4 2½	4 1	3 6	2 6¼
Half-breadths on diagonal *d*	1 3	2 7½	3 8¾	4 4	4 6½	4 5¾	4 1¾	3 4¾	3 2
Half-breadths on diagonal *f*	1 1¾	2 5¾	3 5¾	4 1	4 2½	4 2	3 9	2 9½	1 4
Half-breadths on diagonal *k*	0 11¾	2 1½	2 11½	3 5½	3 6½	3 6	3 0	2 0	5 0¼
Half-breadths on diagonal *m*	0 8¾	1 7	2 3	2 7½	2 7½	2 7	2 2	1 3	0 1½
Half-breadths on diagonal *n*	0 4¾	1 0	1 6	1 8¾	1 9	1 8	1 3	0 7½	0 1½
Half-breadths on diagonal *s*	0 1½	0 6	0 9¾	0 11	0 11½	0 10¾	0 7½	0 3½	0 1½

No. 1 section is 2ft. 8in. from the extreme fore side of stem. All the other stations are 3ft. 6in. apart, but the aft side of transom is only 3ft. 4in. from No. 7 section. The midship section is midway between No. 4 and No. 5 sections.

The water-lines are 1ft. apart.

Diagonal *a* is struck 2ft. 8½in. above the L.W.L., and at *a* 1 and *a* 2 cuts the perpendiculars *p p* 1ft. 5½in. above the L.W.L.

Diagonal *d* is struck 2ft. 2½in. above the L.W.L.

Diagonal *f* is struck 1ft. 7½in. above the L.W.L.

Diagonal *k* is struck 9in. above the L.W.L.

Diagonal *m*, at *m* 1 and *m* 2, is 2ft. 7in. from the middle vertical line *o*.

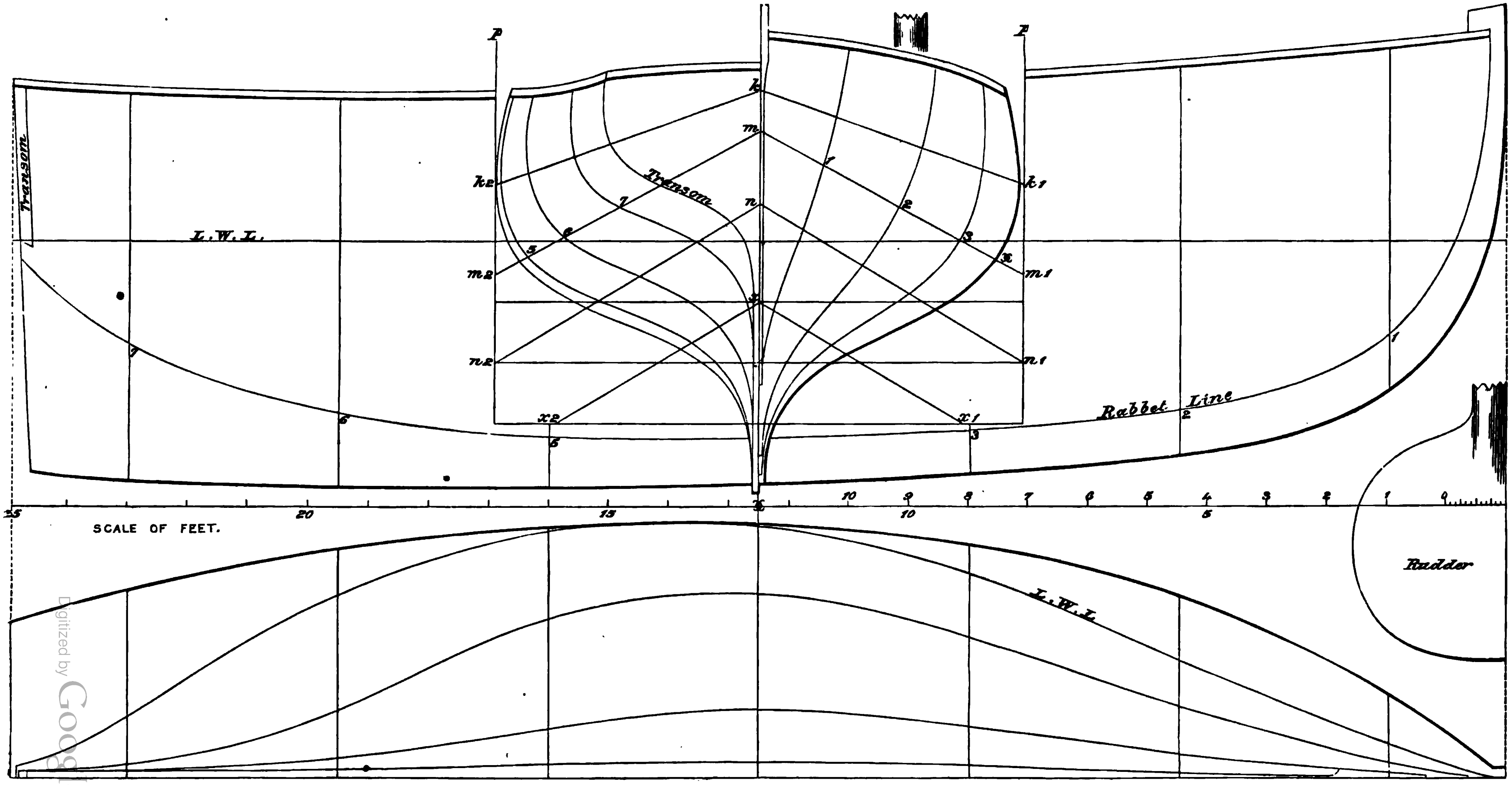
Diagonal *n*, at *n* 1 and *n* 2, is 2ft. 6in. from the middle vertical line *o*.

Diagonal *s*, at *s* 1 and *s* 2, is 1ft. 1in. from the middle vertical line *o*.

All the half-breadths are *without* the plank, but the drawing represents the boat with the plank on.

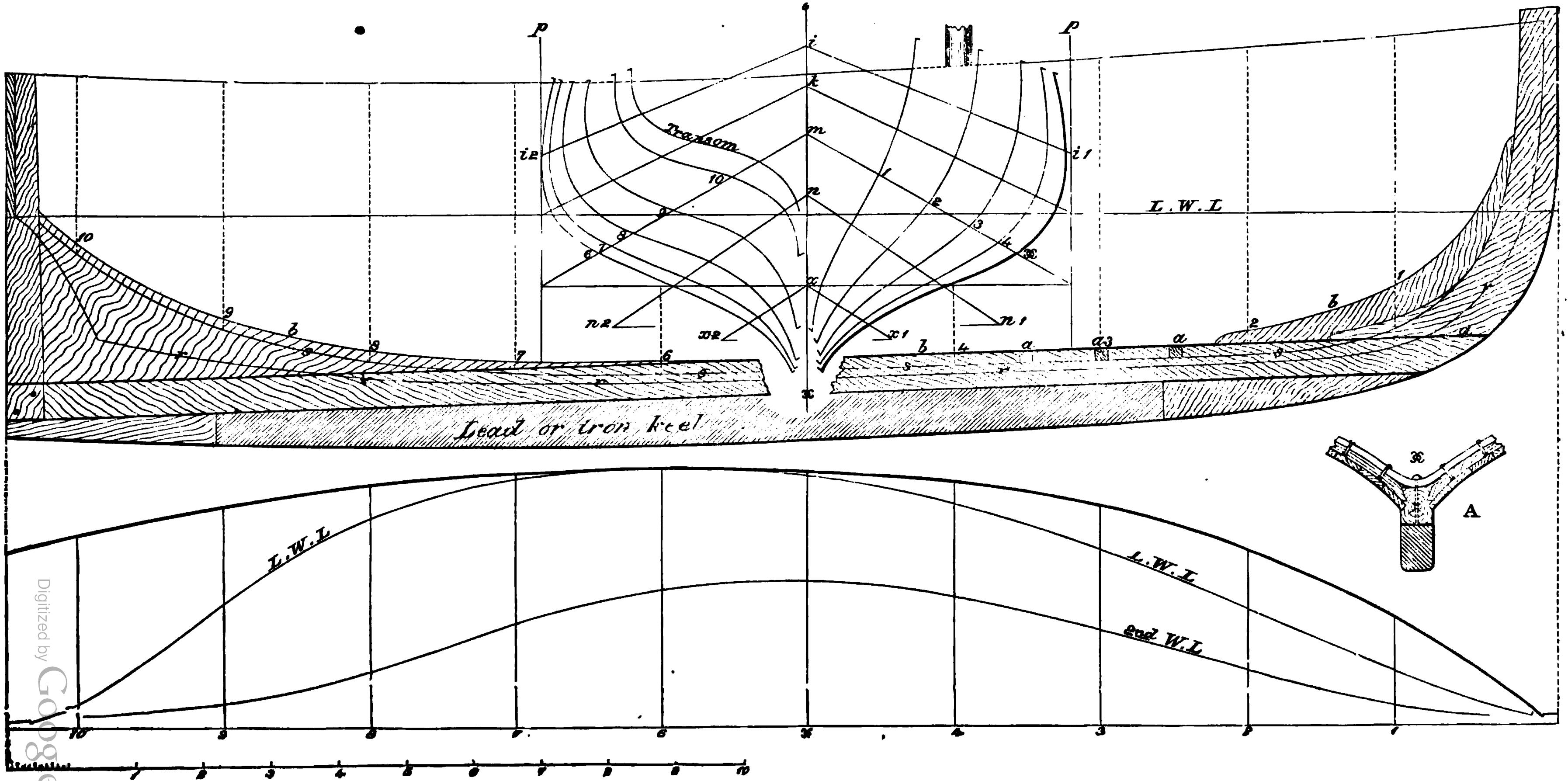
The lead keel will be 21ft. long, 8in. deep at its fore end, 1ft. 1in. at the midship section, 1ft. at No. 7 section, and 9in. at its after end; breadth, 6in. amidships, 3½in. forward, 4in. aft on its upper side; breadth on its under side, 3½in. all through.

PLATE XIX.



"Wild Rose."

PLATE XX.



Itchen Boat "Centipede," 22ft. 8in., and 21ft.

LAYING-OFF TABLE FOR 25FT. BOAT (SEE PLATE XIX.).

No. of Section	1	2	3	4	5	6	7	Trm.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights to top of timbers above L.W.L.	3 2	2 10	2 7¾	2 5¼	2 4½	2 4½	2 5¼	2 7
Depths below L.W.L. to rabbet line	1 6	2 9	3 1	3 2½	3 2	2 10	1 8	—
Half-breadths at gunwale	1 3¾	2 11	3 9	4 0¼	4 0½	3 8½	3 0	2 5
Half-breadths on L.W.L.	0 6	1 11	3 3	4 0	3 11	2 10½	0 9½	0 1½
Half-breadths on diagonal *k*	1 2½	2 10½	3 11½	4 6	4 5½	3 11¼	3 1	2 6
Half-breadths on diagonal *m*	1 0½	2 7½	3 8½	4 4½	4 3	3 6	2 4½	1 9
Half-breadths on diagonal *n*	0 8½	1 11	2 10	3 3½	3 0	2 2½	1 1	0 5½
Half-breadths on diagonal *x*	0 1½	0 10	1 3½	1 6½	1 8½	0 8	0 1½	0 1

No. 1 section is 2ft. from the extreme fore side of stem; all the other sections are 3ft. 6in. apart, but the transom is (at the deck) 2ft. from No. 7 section.

The water-lines are 1ft. apart.

Diagonal *k* is struck 2ft. 6in. above the L.W.L., and at *k* 1 and *k* 2 cuts the side perpendiculars *p p* 11½in. above the L.W.L.

Diagonal *m* is struck 1ft. 9in. above the L.W.L., and at *m* 1 and *m* 2 cuts the side perpendiculars *p p* 6½in. below the L.W.L.

Diagonal *n* is struck 7½in. above the L.W.L., and at *n* 1 and *n* 2 cuts the side perpendiculars *p p* at 2ft. below the L.W.L.

Diagonal *x* is struck 1ft. below the L.W.L., and at *x* 1 and *x* 2 is 3ft. 4in. from the middle vertical line of the body plan.

All the half-breadths are *without* the plank just as the others are, in readiness for setting off in the mould loft; but the design is shown with the plank on. The design also shows a keel of only 3in. siding amidships, instead of the thickness we have given in the table.

LAYING-OFF TABLE FOR 22FT. 8IN. BOAT (SEE PLATE XX.).

No. of Section	1	2	3	4	5	6	7	8	9	10	Trm.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights to top of timbers above L.W.L.	2 6½	2 5	2 3	2 1½	2 0½	1 11½	1 11	1 11½	1 11½	2 0½	2 1
Depths below L.W.L. to stepping line (*s*)	1 8	2 0½	2 1½	2 2	2 3	2 3½	2 3	2 1	1 8	0 6½	—
Half-breadths at gunwale	1 6½	2 6½	3 2½	3 6½	3 8½	3 9	3 8½	3 5½	3 2	2 9	2 5½
Half-breadths on L.W.L.	0 8½	1 8	2 6½	3 3½	3 8	3 9	3 6½	3 0½	1 8½	0 3½	0 1
Half-breadths on 2nd W.L.	0 3½	0 9	1 4½	1 10	2 1½	2 0	1 5½	0 8½	0 3	0 1	—
Half-breadths on diagonal *i*	1 7½	2 7½	3 4½	3 10½	4 2	4 2½	4 1	3 10	3 5½	2 10½	2 7
Half-breadths on diagonal *k*	1 5½	2 5	3 2	3 9½	4 1½	4 2	4 0½	3 8	3 1½	2 3½	1 10½
Half-breadths on diagonal *m*	1 2½	2 0½	2 8½	3 2½	3 6½	3 6½	3 4½	2 11	2 2½	1 3	0 10
Half-breadths on diagonal *n*	0 9	1 4½	1 11	2 3	2 4½	2 4	2 1½	1 8½	1 1	0 4	0 1½
Half-breadths on diagonal *x*	0 2½	0 6½	0 10	1 0½	1 1½	1 0½	0 9½	0 6½	0 3½	—	—

No. 1 section is 2ft. 4in. from the extreme fore side of the stem. All the other sections are 2ft. 2in. apart, but the aft side of transom is only 10in. from No. 10 section.

The water-lines are 1ft. apart.

Diagonal *i* is struck 2ft. 5in. above the L.W.L., and at *i* 1 and *i* 2 cuts the perpendiculars *p p* 10in. above the L.W.L.

Diagonal *k* is struck 1ft. 10in. above the L.W.L.

Diagonal *m* is struck 1ft. 1½in. above the L.W.L.

Diagonal *n* is struck 3in. above the L.W.L., and at *n* 1 and *n* 2 is 2ft. 10in. from the middle vertical line *o*, and 1ft. 7in. below the L.W.L.

Diagonal *x* is struck at the 2nd water-line, and at *x* 1 and *x* 2 is 1ft. 3in. out from the middle vertical line *o*, and 1ft. 9½in. below the L.W.L.

The side perpendiculars *p p* are 3ft. 11in. out from the middle vertical line.

All the half-breadths are *without* the plank, and the boat is represented in the drawing *without* the plank.

Depth of lead keel at its fore end, 7in.; at its amidships, 8½in.; at its aft end, 5½in.

Width (siding) of lead keel at its fore end, 2¾in; at its amidships, 5½in.; at its aft end, 4in.

Length of lead keel, 14ft.

For the 21ft. boat the same laying-off tables will be used, the sections being identical with those of the 22ft. 8in. boat. The spacing between the sections is, however, less.

No. 1 section is 2ft. 2in. from the extreme fore side of the stem; all the other sections are 2ft. apart, but the transom is only 10in. abaft No. 10 section.

SCANTLINGS.

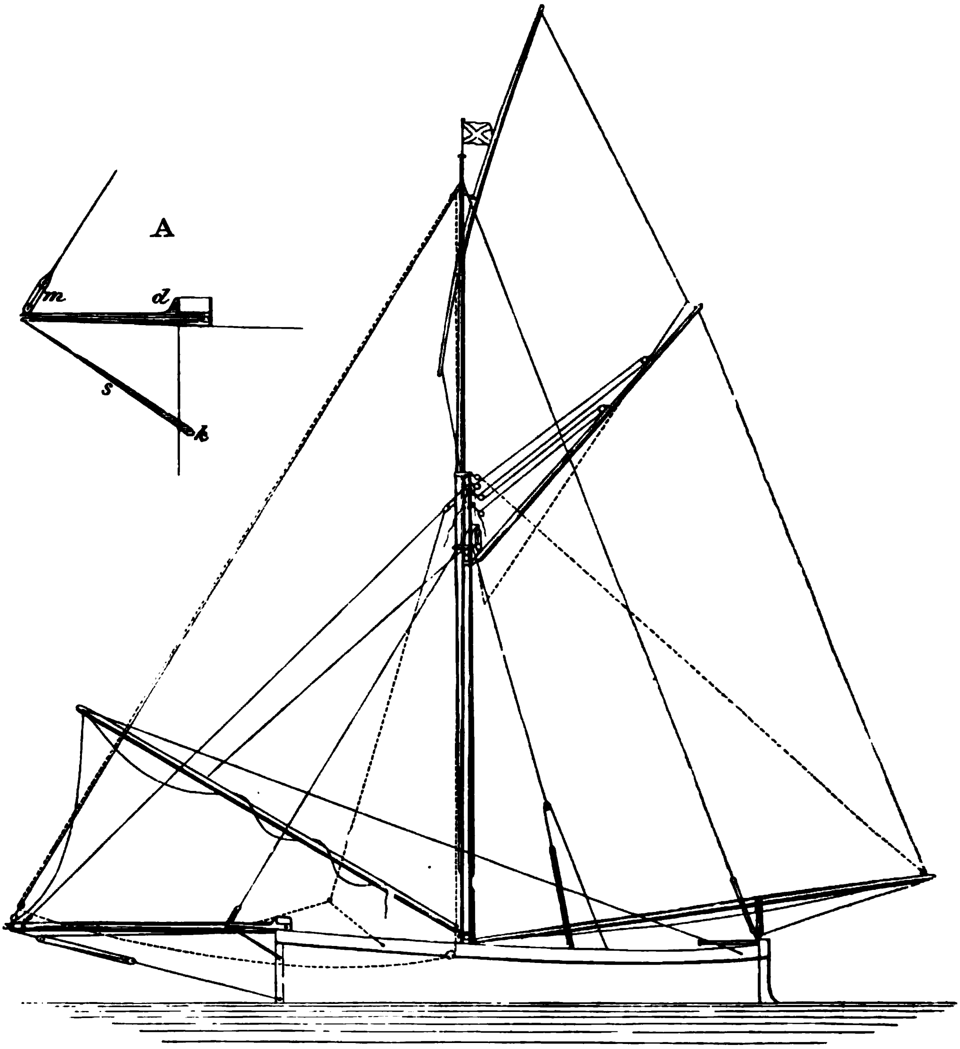
	30ft.	27ft.	25ft.	23ft.	21ft.
Siding of stem	3½in.	3in.	3in.	2¾in.	2¾in.
Siding of sternpost	4in.	3¾in.	3½in.	3¼in.	3in.
Siding of keel amidships	7in.	6in.	6in.	5½in.	5in.
Siding of keel fore end	3½in.	3in.	3in.	2¾in.	2½in.
Siding of keel aft end	4in.	3¾in.	3½in.	3¼in.	3in.
Moulding (depth) of keel	7in.	6½in.	6in.	5½in.	5in.
Siding of timbers	2in.	2in.	1¾in.	1½in.	1½in.
Room and space	1ft. 8½in.	1ft. 9in.	—	1ft. 1in.	1ft.
Thickness of plank*	1in.	1in.	1in.	¾in.*	¾in.*
Thickness of garboard strake	1¼in.	1¼in.	1¼in.	1in.	1in.
Thickness of top strake	1¼in.	1¼in.	1¼in.	1in.	1in.
Thickness of clamp	1½in.	1½in.	1½in.	1½in.	1½in.
Thickness of transom	2½in.	2¼in.	2in.	2in.	2in.
Breadth of rudder	3ft.	2ft. 9in.	2ft. 6in.	2ft. 3in.	2ft.

* An inch strake as a wale should be worked above the water-line at the broadest part of the boat; this will make the boat the required width.

DIMENSIONS, &c.

Length, fore side of stem to aft side transom on deck	30ft. 4in.	27ft.	25ft.	22ft. 8in.	21ft.
Breadth (moulded)	9ft. 4in.	8ft. 4in.	8ft. 7in.	7ft. 10in.	7ft. 10in.
Breadth with plank on	9ft. 6in.	8ft. 6in.	8ft. 9in.	8ft.	8ft.
Draught of water, extreme	5ft. 4in.	4ft. 10in.	4ft. 1in.	3ft. 4½in.	3ft. 4½in.
Displacement	9 tons	6·5 tons	5·8 tons.	3·8 tons	3·5 tons
Displacement per inch of immersion at L.W.L.	9cwt.	7cwt.	6cwt.	5½cwt.	4½cwt.
Weight of ballast inside	3½ tons	2½ tons	2 tons	1¼ tons	1¼ ton
Weight of lead keel	2 tons 8cwt.	1 ton 16cwt.	1½ tons	1 ton	18cwt.
Tonnage Y.R.A.	9 [illegible]/94	7 [illegible]/94	6 [illegible]/94	4 [illegible]/94	4 [illegible]/94

PLATE XXI.



ITCHEN BOAT.

SCALE $\frac{1}{12}$ inch = 1 FOOT.

SPARS AND SAILS.

	30ft.		27ft.		25ft.		23ft.		21ft.	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
Centre of mast from fore side of stem on deck	11	6	10	9	9	9	8	8	8	2
Length of mast, deck to hounds	25	0	22	6	21	6	19	6	18	9
Length of mainboom extreme	27	6	26	0	24	4	21	9	19	3
Length of main gaff extreme	20	6	18	6	17	9	16	8	14	3
Length of bumpkin outside	2	6	2	4	2	0	1	9	1	3
Length of bowsprit outside	16	0	14	6	12	6	12	0	11	6
Length of topmast fid to sheave	20	6	19	6	18	0	17	0	16	0
Length of topsail yard	24	0	23	0	21	0	20	0	18	0
Length of topsail yard	18	0	17	0	16	0	15	0	14	0
Length of spinnaker boom*	27	6	25	0	23	0	21	0	19	0
Luff of mainsail	23	0	20	0	19	3	17	9	16	6
Leech of mainsail	39	0	36	0	34	0	31	0	29	6
Foot of mainsail	27	0	25	9	24	0	21	4	18	10
Head of mainsail	20	2	19	0	17	6	15	8	14	0
Tack to peak earing	41	2	38	0	36	0	33	0	30	0
Clew to weather earing (throat)	32	9	31	0	29	0	27	0	24	0
Foot of foresail	14	6	13	0	11	6	10	0	9	0
Luff of foresail	25	0	23	0	22	0	21	0	17	6
Leech of foresail	23	0	21	0	20	0	18	0	15	6
Foot of jib†	17	0	16	0	15	0	14	0	13	0
Luff of jib	36	0	33	0	30	6	27	0	24	0
Leech of jib	24	0	22		21	0	20	0	17	0

* As they only have one spinnaker, it has to be set on the bowsprit occasionally; hence the length of the spinnaker boom is usually about the length from the mast to the bowsprit end.

† With a reef down the boats are frequently sailed without a jib, the bowsprit being run in and stowed.

CHAPTER XX.

CLYDE SAILING BOATS.

WITHIN the last three or four years, open boat sailing has become wonderfully popular on the Clyde, and this is hardly to be wondered at, as the Firth offers special opportunities for this capital sport. Snug anchorages, fairly smooth water, little, or no run of tide, and the facilities given by the railway and steam boat companies for readily getting from the city to the coast, induce most young fellows who are in the least degree nautically inclined to keep a boat of some sort; and during the summer months, in the bright northern evenings, from every coast village may be seen a fleet of little vessels flitting along the shore in the smooth water, and lying over to the land wind, which, in good weather, rises as the sun sets. Many of these boats are racing craft, and as each principal waterplace has its local lugsail club, there is no lack of sport on the Saturday afternoons, there being always one, and sometimes two or three events for the little ships. As the prizes are of considerable value, and quite worth winning,* the class of boat has been gradually improved, and while three years ago they were simply ordinary fishing skiffs, ballasted with stones or sand bags, these have given place to such powerful craft as shown in the drawing, with lead keels, spinnakers, and all the modern racing paraphernalia.

The boats are divided for racing purposes into three classes, 17ft., 19ft., and 22ft. The drawing shows a 19ft. boat on a scale of ½in.=1ft., but tables of offsets and proportional scales are given, so that it can be used for all three sizes; there are also a few 15ft. boats, but the principal racing is among the larger ones. Till last year the only dimension taken into account was length, that being measured over all, but as this was thought likely to produce a fleet of "Popophgas," the ordinary Y.R.A. rule was adopted by the Western and Royal Aquatic Clubs, the classes being now fixed at 1½, 2½, and 3½ tons, so as not to disclass existing boats. As far as possible time allowances are discouraged, and no *new* boats are given time, but those built prior to 1878 get time from their larger rivals according to the following scale, which has worked fairly well in practice:

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* The prizes of one 19ft. boat, the Vanguard, amounted last season to £35, while the 22ft. boat, Thisbe, netted over £45.

For 17ft. boats, 12 seconds per ¼ ton per knot.
For 19ft. boats, 10 „ „ „
For 22ft. boats, 8 „ „ „

Excepting one or two of the earlier boats, all are built with square sterns, the increased power got by this form apparently making up for the unavoidable drag aft, while the over-all measurement, which prevails in most of the clubs, precludes a counter. It is questionable, however, whether a short neat counter could not be made "to pay," at least in heavy weather, and when the boats are necessarily travelling at a high speed; though at small inclinations, and speeds up to three or four miles an hour, this form of after end leaves the water smoothly enough, the stern board being then fairly out of water.

An idea of the advance made in the building of these craft may be gleaned from the following table of particulars of the best boats of their day:

Date of building	1873.	1875.	1877.	1878.
Name of boat	NEVA.	LILY.	VANGUARD.	*Building.*
Builder	M'Inistan.	Fife.	Paton.	Paton.
	ft. in.	ft. in.	ft. in.	ft. in.
Length	18 9	19 0	19 0	19 0
Breadth	5 7	5 8	5 6	6 0
Depth from top of gunwale to top of keel	2 0	2 4	2 8	3 3
Freeboard	1 3	1 5	1 8	1 10
Draft aft	1 9	2 0	2 3	2 4
Draft forward	1 4	1 4	1 6	1 6
Mast, extreme length	20 0	—	21 0	21 0
Yard, extreme length	19 0	—	19 6	19 6
Weight of ballast inside	6cwt.	10cwt.	17cwt.	20cwt.
Weight of ballast on keel	none	none	none	3cwt.
Displacement (about)	11cwt.	16cwt.	24cwt.	31cwt.

The steady increase of displacement is the most remarkable feature in this table, it presenting indeed but a microcosmic history of yacht-building from the time of "America" to "Vanessa."

The boats are generally entirely open, but the Largs and Western Clubs intend allowing a deck in future, while one or two clubs even now permit the boat to be covered from the mast forward, the space below forming what is called "the den," where provisions, &c., may be kept dry, and where the luxurious owner and friends sleep when away on a cruise, covering the other four feet of their bodies with a tarpaulin.

There being no inducement (as in the case of the New Brighton boats) to cut down free board, they are given plenty of it, some as much as 24in., the average, as may be seen from the table, being about 22in. for a 19ft. boat, which is not found too much for the heavy sea which a sou'-wester tumbles up between Cumbrae and Porten Cross. Even with this a quantity of water gets aboard, and employs any spare hand baling besides the man at the pump. All the best boats are fitted with large pumps, 2½in. and 3in. in the barrel; they are generally on the aft thwart with discharge to both sides, or through the bottom. An ingenious, albeit expensive kind of pump has been adopted in one or two instances; this is shown in the mid section and general plan (Fig. 69, and Plate XXIII.)—the barrel is pivoted at the foot so as to cant over to either side of the boat, the pumper being thus able to sit up in the weather bilge while at work. The discharge of this pump was through the lower part of the stern board, possibly after the idea of Ruthven's jet propeller.

The general construction and arrangement of these boats is shown in the drawings (Plate XXIII.), and the scantlings are in pretty close accordance with the following tables, but some of the fittings, being as far as we know, peculiar to these boats, deserve particular mention, such as the ballast shelf, mainsheet horse, &c. These are illustrated in the cuts, and their uses further explained by the text.

TABLE OF SCANTLINGS AND DIMENSIONS OF SPARS.

Length of boat	17ft. boat	19ft. boat	22ft. boat
Beam, extreme	5ft. 4½in.	6ft.	7ft.
Depth from top of gunwale to top of keel amidships	3ft. 0½in.	3ft. 4in.	3ft. 11½in.
Keel, of American elm, sided	2in.	2¼in.	2¾in.
Keel, of American elm, moulded	6in.	7in.	8in.
Apron, of American elm	3¼in. × ¾in.	3½in. × 1in.	4in. × 1¼in.
Frames, all bent, sided	1in.	1⅛in.	1¼in.
Frames, all bent, moulded	¾in.	⅞in.	1⅛in.
Frames, spaced centre to centre	8in.	9in.	9½in.
Floors, of oak (in every alternate frame space), sided	1⅜in.	1¾in.	2¼in.
Floors, moulded at throat	3in.	3½in.	4½in.
Stem, of oak, sided	1¾in.	2in.	2½in.
Stem of oak, moulded (about)	6in.	7in.	8in.

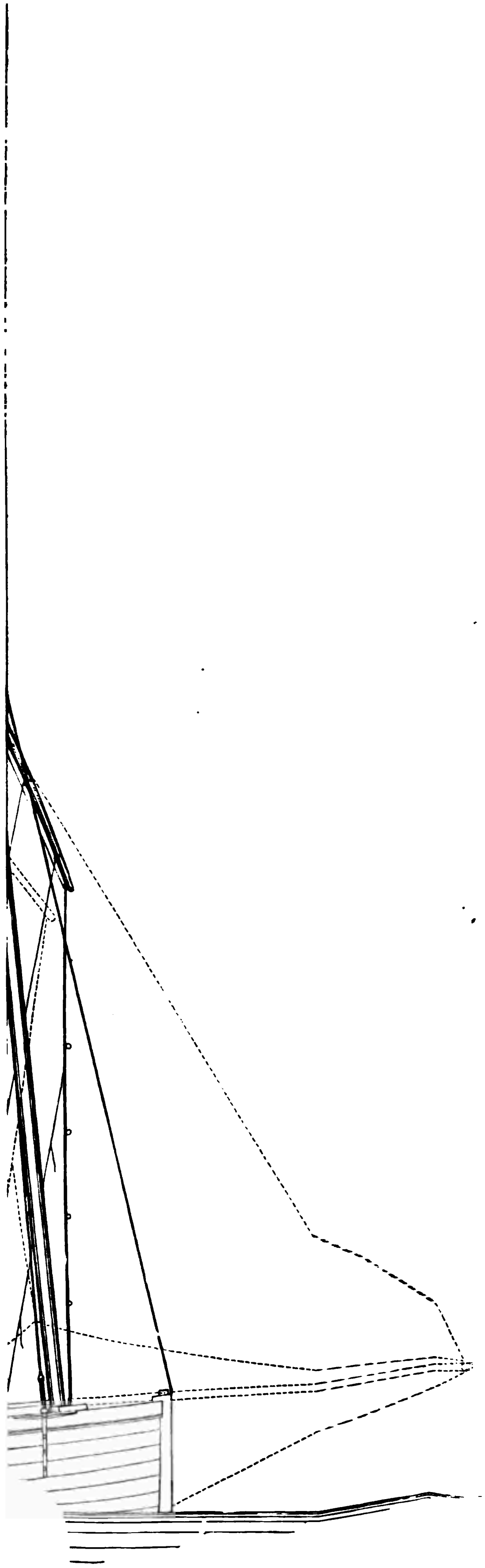

TABLE OF SCANTLINGS AND DIMENSIONS OF SPARS—*continued.*

Sternpost, of oak, sided	2in.	2¼in.	2½in.
Sternpost, of oak, moulded at keel	7in.	8in.	9in.
Sternboard, of oak, thick	1in.	1⅛in.	1¼in.
Gunwale, American elm	1½in. × 1¼in.	2in. × 1½in.	2¼in. × 1¾in.
Planking, garboard strake, elm	6in. × 7/16in.	6in. × ½in.	6in. × ⅝in.
Planking, thence to sheer strake, yellow pine	5in. × 7/16in.	5in. × ½in.	5½in. × ⅝in.
Planking, sheer strake, mahogany	5½in. × ½in.	5½in. × ½in.	6in. × ⅝in.
Thwarts	7in. × 1in.	7in. × 1⅛in.	7in. × 1¼in.
Thwarts, mast thwarts	7in. × 1⅜in.	7in. × 1½in.	7in. × 1¾in.
Wirings, elm	3in. × ⅞in.	3½in. × 1in.	3½in. × 1⅛in.
Mast beam, double-kneed, with lodging knee to wiring	2in.	2¼in.	2½in.
Mast, deck to hounds	18ft.	19ft. 6in.	20ft.
Mast, hounds to truck	—	—	9ft.
Mast, diameter at deck	3¾in.	4in.	4¾in.
Yard or gaff, length extreme	18ft.	20ft.	14ft.
Yard or gaff, diameter at slings	2⅜in.	2¾in.	2½in.
Cruising yard or gaff, length extreme	15ft.	17ft.	—
Cruising yard or gaff, diameter at slings	2⅛in.	2¼in.	—
Boom, length extreme	16ft.	18ft.	18ft.
Boom, diameter at sheet	2½in.	2¾in.	2¾in.
Bowsprit, outboard	5ft.	5ft. 6in.	10ft.
Bowsprit, diameter at gamoning iron	2in.	2¼in.	2¾in.
Spinnaker or shadow sail boom, length extreme	16ft. 6in.	18ft. 6in.	21ft.

In the larger boats, and where there is an extra heavy lead keel, a keelson may be advantageously adopted.

The weight of a 17ft. boat built to these scantlings would be about 5cwt., hull, spars, sails, &c., complete, of a 19ft. boat 7cwt. to 8cwt., while a 22ft. boat would weigh 15cwt. to 18cwt. The displacements if built to this drawing, being 22cwt., 31½cwt., and 49cwt., would leave 17cwt., 22cwt., and 31cwt. for ballast and crew. Of this ballast, one-fourth might advantageously be put on the keel, but, unless lead were used, this amount could not be got in the space at disposal.

The usual rig for boats 19ft. and under is a single standing lug, as shown in the plan (Plate XXII.), but for cruising and for racing, in some of the clubs, a standing lug, with boom on foot, and short bowsprit with jib, are used; these are shown in the plan by dotted lines. For the single lug the mast is stepped about one-seventh of the boat's length from the stem, for the lug and jib about 18in. further aft. Most of the boats are fitted for both rigs, and farther, have several mast steps, so that the rake of the mast may be altered. One of the mast beams is generally bolted to the gunwale, the latter being strengthened at the part by a heavy clamp piece running two to three feet fore and aft. The mast is further supported by a wire shroud on each side, and a forestay (1¼ steel). These are shackled to the cranse at the masthead, made as shown in Fig. 68, and have a large thimble spliced in at the other end to take the lanyard. Many of the boats are fitted with "channels," to give more spread to the rigging, the mast being so far forward, so lofty, and the boats so fine in the nose, that without these the shrouds would give little support; they are of the "skeleton" kind, being made as shown in the sketch. The lengths and diameters of mast and spars are given in the table. A traveller works on the mast, and in construction is identical with that of the New Brighton boats described at page 177, the hook being welded solid on the ring, and hooking into a selvedge strop on the yard, the halyard (2in. tarred hemp) being spliced into its eye. But into the other end of the halyard a double block is spliced; and a fall rove through this, and a single block at the foot, forms a luff tackle purchase for hoisting. The single thick rope is cut a foot or eighteen inches short, so that the yard has to be lifted up and hooked on;

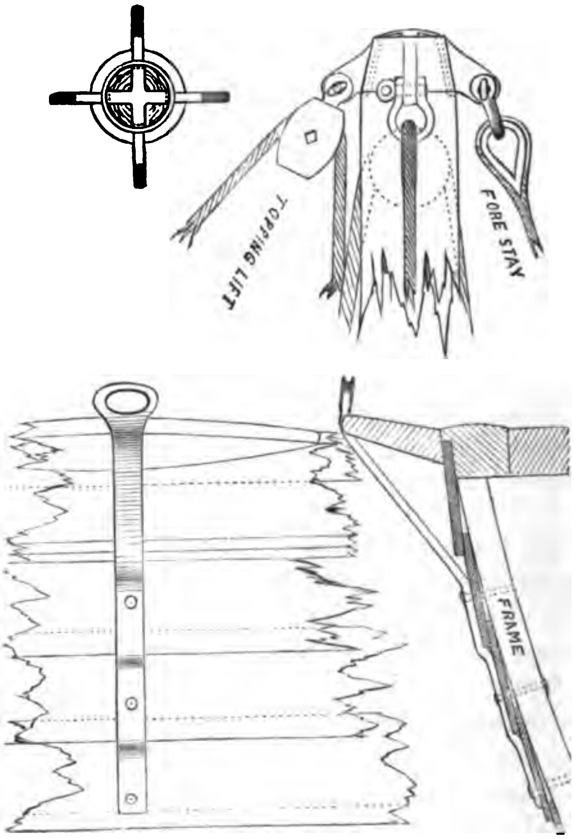

FIG. 68.

this of course is necessary, that the sail may be hoisted "chock-a-block." The tack is simply slipped on to a hook in the mast beam, the tackle on the halyards bringing the necessary strain on the luff to peak the sail. The mainsheet is a gun-tackle purchase, the upper block shackling on to the clew of the sail, while the lower has a thimble spliced on its tail, which works on the horse across the stern, as shown in the sketch (Fig. 69). When the boom lugsail is in use, the same sheet is simply shackled into a strop on the boom, thus doing for both. It is evident that by carrying the horse back, say a couple of feet (which might easily enough be done), all the advantages of a boom sail could be retained; there is, therefore, a rule which enacts that "if a horse is used it must be at right-angles to the keel."

The spars and sails carried by these boats are enormous; one 19ft. boat, indeed, having a mast, 21ft. deck to hounds, or 18in. longer than the five-tonner Diamond. She, however, was exceptionally heavily sparred, the general proportions being:

	Luff.	Head.	Foot.	Leech.
	ft. in.	ft. in.	ft. in.	ft. in.
19ft. boats	12 6	16 0	14 6	25 6
17ft. boats	12 0	14 6	13 6	23 0

which dimensions have been kindly given us by Mr. D. M'Kenzie, of Greenock, the local lugsail Lapthorne.

With such canvas aloft, the latest improvements in ballasting must be adopted, and the new boats are all fitted with metal keels, 3 cwt. to 5 cwt. in weight. In one or two, all the internal ballast is also lead; but, whether lead or iron, it is neatly cast in blocks, weighing about a hundredweight, which fit close down to the skin, but hang entirely on the keel and floor timbers. As shifting ballast is allowed in the Largs Club, most boats, whether belonging to this club or no, are fitted with a shelf for stowing weather ballast in each bilge, as shown in the arrangement plan and midship section (Plate XXIII. and Fig. 69). This shelf also makes a capital seat for the crew, where they are well up to windward and also in shelter. The celebrated Largs boat Neva (possibly borrowing the idea from the China clippers, which, when racing, hung water-butts over the weather side) used to get her ballast still farther to windward, by slinging pretty nearly all of it (some 6cwt.) right outside. The Western Yacht Club, however, has most stringent rules against shifting ballast, and rigidly enforces these rules, also limiting the crew to three in the 17ft. and 19ft. boats, and four in the 22ft. boats, so as to prevent, as far as may be, "live ballast."

These boats go out in pretty well any weather, the sail reefing down very snug, and the boats, when not recklessly driven, being most seaworthy little craft. Accidents of any kind are therefore rare, and we cannot call to mind a fatal one, owing doubtless to the excellent rule enforced in all the clubs, that "every boat shall carry life-saving apparatus sufficient to float every person on board." The modern craft seldom or never miss stays, but in the event of their doing so, it is admissible to use an oar to put them round, "but the strokes are to be backward, and in no case to be ahead," a very necessary clause, as before its introduction, a

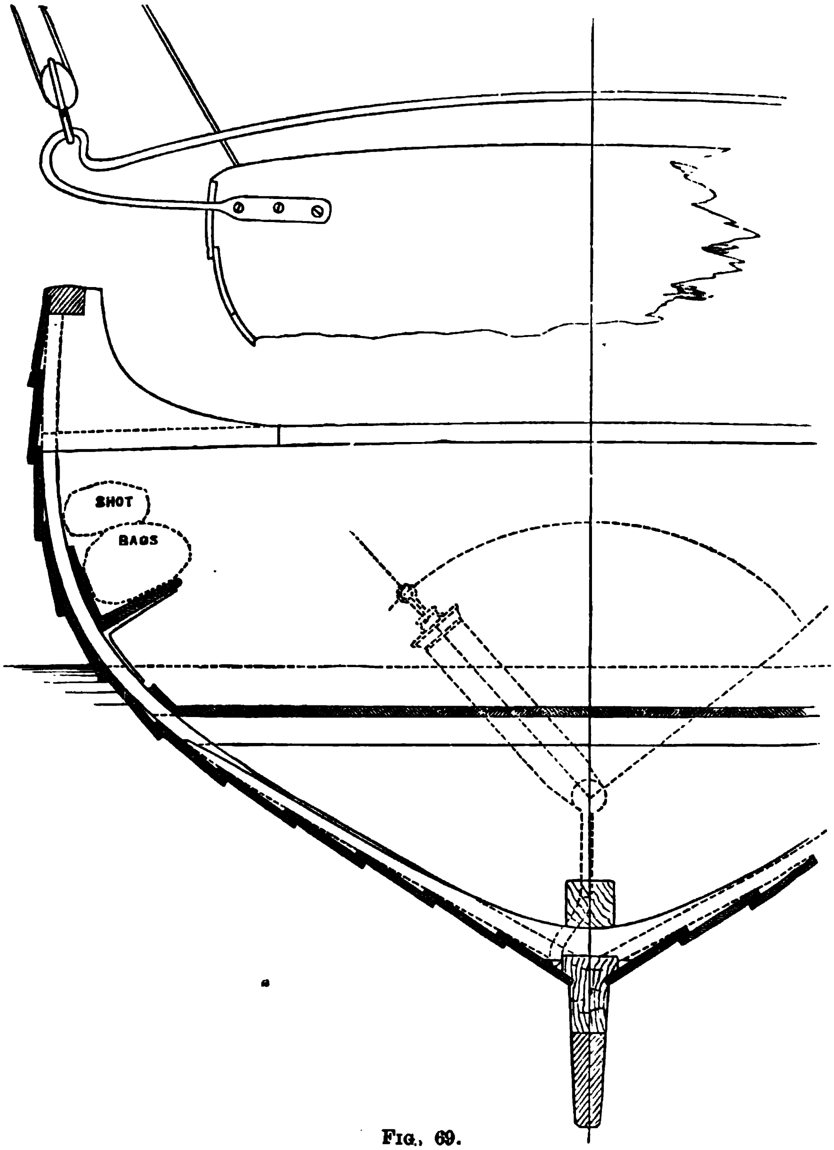

FIG. 69.

morbid horror of missing stays prevailed, especially in calm weather. In running, the Western Club permits no extra sails, and does not even allow "booming out,"* but in the other clubs there are no such restrictions, and spinnakers, or more generally "shadow sails," are set for the run. The shadow sail is generally an old lug sail hoisted opposite the other, and the boom shipped into a snotter on fore side of mast.

The 22ft. boats are invariably rigged as cutters, with mainsail, foresail, and jib, and small topsail on the pole mast. They carry also the usual balloon canvas for running to leeward, and occasionally indulge even in jib topsails. In the following table we give particulars of the best boats in this class, the "Thisbe," built by McLaren, of Kilcreggan, and owned by Mr. Allan Macintyre, and the "Ayrshire Lass," built by Fife for Mr. Thomas Reid, of Paisley. It is by the courtesy of these gentlemen we are enabled to give the following particulars. Alongside are given those of a 22ft. boat built to our drawing.

Name	Thisbe.	Ayrshire Lass.	Design.
Length, extreme	21ft. 11in.	22ft.	22ft.
Breadth, extreme	6ft. 11in.	7ft.	7ft.
Draught of water aft	3ft. 8in.	3ft. 6in.	3ft. 2in.
Draught of water forward	2ft.	2ft. 6in.	1ft. 9in.
Displacement (about)	3·15 tons	2·4 tons.	2·45 tons
Ballast (total)	2 tons 5cwt.	1 ton 10cwt.	1 ton 11cwt.
Ballast lead inside	1 ton 9cwt.	1 ton 4cwt.	18cwt.
Ballast iron inside	—	10cwt.	—
Ballast on keel	16cwt.	6cwt.	13cwt.
Mast, deck to hounds	20ft. 6in.	19ft.	20ft.
Boom, extreme	18ft.	19ft.	18ft.
Gaff, extreme	14ft.	15ft.	14ft.
Bowsprit, outside	10ft.	12ft.	10ft.
Area of plain sail	513 sq. ft.	520 sq. ft.	500 sq. ft.

The Clyde boats are invariably clencher built, so that in the event of anyone building to our drawings, it would be necessary to put up a "roof tree" between stem and stern post, then make half moulds for, say, 2, 4, 6, and 8 sections, pivoting these on their centre lines so as to swing round and do for both sides. She may be planked to these moulds, the frames then bent in, and last of all the floors, as if the floors are put on before planking it is unlikely that the bottom will be kept as fair. The sections can be drawn down full size from the following tables of offsets.

In all cases the water-lines are named from the load, or first water-line,

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* This rule is altered for next season, so that now there will be no restriction as to sails, or mode of setting them.

down (see Fig. 70). The diagonals are also named in like manner, the *top* one being *first* diagonal, and so on. The gunwale heights and breadths explain themselves. The dimensions given are in all cases *moulded,* that is, to the inside of the plank. If it is desired to make calculations of any elements of these boats, once and a half the thickness of plank must be drawn on.

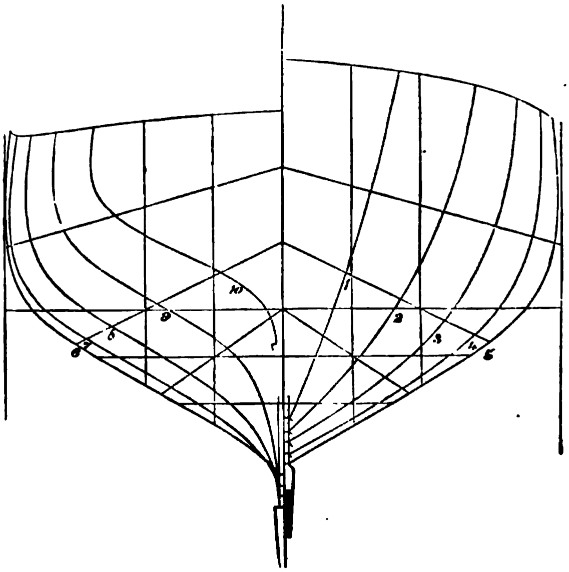
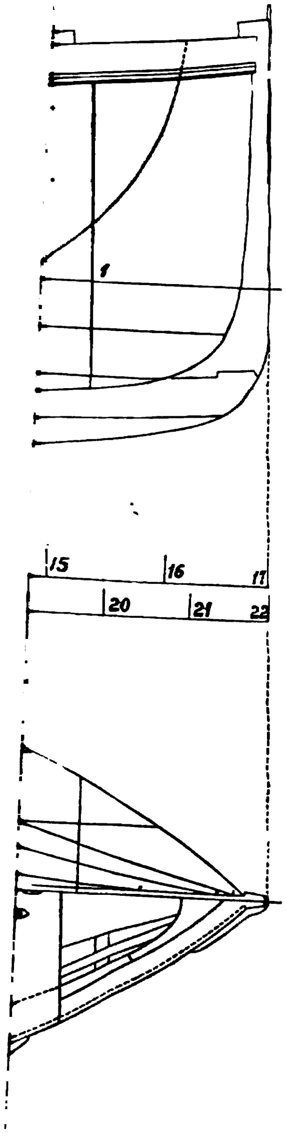


Fig. 70.

The stations (see Plate XXIII.) are spaced exactly $\frac{1}{10}$th of the extreme length apart, and are at right angles to the water line. The shape of sternboard is shown in projection on the body plan; in laying it down for building, the rake of post would have to be allowed for to get the *actual* shape.

TABLE OF OFFSETS FOR A 17FT. BOAT.

No. of Section	1	2	3	4	5	6	7	8	9	10
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	2 2⅜	2 1⅝	1 11⅝	1 10⅜	1 9⅜	1 8⅜	1 7⅜	1 7⅜	1 8	1 8⅝
Depths below L.W.L. to rabbet	1 0	1 1⅛	1 2⅜	1 4	1 5½	1 6⅝	1 7⅜	1 8⅜	1 8⅜	—
Half-breadths at gunwale	1 1½	1 9⅝	2 2⅛	2 4⅝	2 6	2 6⅛	2 5½	2 4⅛	2 1½	1 9
Half-breadths at L.W.L.	0 5⅜	1 0⅝	1 6⅜	2 0$\frac{1}{16}$	2 8	2 3⅜	2 2¾	1 10	1 0⅜	0 1⅝
Half-breadths, No. 2 W.L.	0 3½	0 8⅛	1 1⅜	1 6$\frac{1}{16}$	1 8⅜	1 8⅝	1 6⅛	1 0⅝	0 5⅛	0 0⅝
Half-breadths, No. 3 W.L.	0 1	0 3⅛	0 7$\frac{1}{16}$	0 10	0 11½	0 11⅛	0 8⅜	0 5⅛	0 2	0 0⅛
Half-breadths on 1st diagonal	0 10½	1 6⅜	2 0⅜	2 5	2 7½	2 8½	2 7¼	2 5⅝	2 1½	1 7½
Half-breadths on 2nd diagonal	0 8	1 2⅜	1 8⅛	1 11⅛	2 2	2 2⅛	2 0¼	1 9⅛	1 3⅜	0 7½
Half-breadths on 3rd diagonal	0 5⅝	0 10$\frac{1}{16}$	1 1⅛	1 3⅜	1 4½	1 4½	1 3⅛	1 0⅜	0 7⅜	0 1⅜



The stations are spaced 1·7ft. apart (1ft. 8⅜in.), No. 1 station being the same distance from fore-side stem. The water lines are a bare 5⅜in. apart; the more exact way to lay them off will be to measure 16in. below the load line, and divide it into three equal parts.

The side lines are parallel to the centre line, and 2ft. 7¼in. out.

The first diagonal cuts the centre line 1ft. 3⅜in. above the load line, and cuts the side line 7in. above load line.

The second diagonal cuts the centre line 7½in. above the load line, and the side line 7¼in. below it.

The third diagonal cuts the centre line *at* the load line, and cuts the third water line 1ft. 3¼in. out.

TABLE OF OFFSETS FOR A 19FT. BOAT.

No. of Section	1	2	3	4	5	6	7	8	9	10
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	2 6	2 4¼	2 2⅜	2 1⅜	1 11⅞	1 10⅞	1 10½	1 10⅜	1 10⅜	1 11⅜
Depths below L.W.L. to rabbet	1 1⅜	1 3¼	1 4⅜	1 6	1 7⅝	1 8⅝	1 10½	1 11⅜	1 11⅜	—
Half-breadths at gunwale	1 2⅝	2 0	2 5½	2 8¼	2 9⅝	2 10	2 9½	2 7⅜	2 4½	2 0
Half-breadths at L.W.L.	0 6⅜	1 1⅞	1 9	2 3	2 6⅝	2 7⅝	2 5⅞	2 0⅞	1 2⅝	0 1⅞
Half-breadths, No. 2 W.L.	0 3⅝	0 9⅜	1 3⅝	1 8⅝	1 11⅜	1 11¼	1 8⅝	1 2½	0 5⅞	0 0⅝
Half-breadths, No. 3 W.L.	0 1⅜	0 4	0 7⅞	0 11¼	1 1⅜	1 1	0 10¹⁄₁₆	0 6	0 2¹⁄₁₆	0 0⅝
Half-breadths on 1st diagonal	0 11⅜	1 9	2 3½	2 8⅝	2 11⅜	3 0⅜	2 11⅜	2 9	2 4⅝	1 9⅞
Half-breadths on 2nd diagonal	0 8⅞	1 4⅜	1 10⅝	2 2⅞	2 4⅞	2 5⅜	2 8⅝	2 0	1 5⅜	0 8⅜
Half-breadths on 3rd diagonal	0 6¹⁄₁₆	0 11⅜	1 3⅝	1 5⅞	1 6⅞	1 6⅞	1 5½	1 2⅜	0 8¼	0 2

The stations are spaced 1·9ft. apart (1ft. 10¾in.), No. 1 station being the same distance from fore-side stem.

The water lines are spaced exactly 6in. apart.

The side lines are parallel to the centre line, and 2ft. 11in. out.

The first diagonal cuts the centre line 18in. above the load line, and cuts the side line 8in. above load line.

The second diagonal cuts the centre line 8½in. above the load line, and the side line 8¼in. below it.

The third diagonal cuts the centre line *at* the load line, and cuts the third water line 1ft. 5¼in. out.

TABLE OF OFFSETS FOR A 22FT. BOAT.

No. of Section	1	2	3	4	5	6	7	8	9	10
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Heights above L.W.L. to top of gunwale	2 10⅞	2 8⅜	2 6⅞	2 5	2 3⅝	2 2⅜	2 1⅞	2 1⅜	2 1⅞	2 2⅝
Depths below L.W.L. to rabbet	1 8⅜	1 5⅜	1 7⅝	1 8⅞	1 10⅜	2 0	2 1½	2 3½	2 3¼	—
Half-breadths at gunwale	1 5	2 3⅞	2 9⅞	3 1¼	3 2⅝	3 3⅝	3 2½	3 0⅜	2 8⅞	2 3⅜
Half-breadths at L.W.L.	0 7⅝	1 3⅞	2 0⅝	2 7⅝	2 11¹⁄₁₆	3 0¹⁄₁₆	2 10⅜	2 4⅝	1 4⅜	0 2⅜
Half-breadths at 2nd W.L.	0 4⅝	0 11¼	1 5¾	1 11⅝	2 2¾	2 2⅞	1 11⅝	1 4⅝	0 6⅞	0 1
Half-breadths at 3rd W.L.	0 1⅝	0 4¾	0 9⅜	1 0⅞	1 3⅜	1 2¾	0 11⅞	0 7⅝	0 2⅜	0 0⅞
Half-breadths on 1st diagonal	1 1¼	2 0⅝	2 8¼	3 1⅜	3 4⅝	3 5¼	3 5	3 2¼	2 9⅜	2 1⅜
Half-breadths on 2nd diagonal	0 10⅜	1 7¼	2 2¼	2 7¼	2 9⅝	2 10	2 8	2 3⅞	1 8⅜	0 10⅝
Half-breadths on 3rd diagonal	0 7⅜	1 1	1 5¼	1 8⅞	1 10	1 10	1 8	1 4¾	0 10⅜	0 2⅝

The stations are spaced 2·2ft. apart (2ft. 2⅜in.), No. 1 station being the same distance from fore-side stem.

The water lines are spaced exactly 7in. apart.

The side lines are parallel to the centre line, and 3ft. 4¼in. out.

The first diagonal cuts the centre line 1ft. 8½in. above the load line, and cuts the side line 9in. above load line.

The second diagonal cuts the centre line 9⅜in. above the load line, and the side line 10¼in. below it.

The third diagonal cuts the centre line *at* the load line, and cuts the third water line 1ft. 8¼in. out.

As to cost, a modern racing 19ft. boat is a pretty expensive toy. About the most successful builder of them, Paton, of Milport, charges 22*s*. to 23*s*. per foot, and other builders are pretty much the same; the items, therefore, would tot up about as follows:

	£	*s*.	*d*.
Hull and spars, 19ft., at 23*s*. per foot	21	17	0
Plain, pump, and other fittings not supplied by builder ...	3	10	0
Lead keel, 6cwt., at 23*s*. per cwt.	6	18	0
Internal ballast, 10cwt., at 22*s*. 6*d*. per cwt.	11	5	0
Shot in bags, 4cwt., at 32*s*. per cwt.	6	8	0
Blocks, running and standing rigging	8	0	0
Sails	15	0	0
Three life belts, at 15*s*.	2	5	0
Total for boat complete and ready for racing ...	£75	3	0

If internal ballast is of iron, deduct £8 10*s*.

CHAPTER XXI.

PENZANCE LUGGERS.

Penzance Luggers enjoy a very considerable reputation for weatherliness, and it has even been said that in this quality they exceed the famous cutter yachts of this kingdom. Be this as it may, there is no doubt that with two large and well cut sails, a sharp entrance, and equally sharp run, they are highly adapted for sailing by the wind. They vary in length from 40ft. to 52ft. length of keel, and have a good proportion of beam, usually a little less than one-third the length on deck, or about 0·3 of that length. The greatest beam is on deck, the turn of the bilge is very easy, and the floors nearly straight, with but little dead rise. The displacement of the boats is comparatively small, and, although the greatest transverse section is ahead of the centre of length of load line, yet is the centre of buoyancy a little abaft that centre. The displacement of the fore-body and the displacement of the after-body are thus nearly equal, and this is accounted for by the more or less rake given to the mid-section—so that practically the mid-section is not so far forward as the position shown in the drawing—and to the steepness of the buttock lines aft and the lightness of the draught forward. It will be observed that there is little or no dead wood aft, in fact it is "all vessel" there, and the comparative fulness of the buttock lines is compensated for by the fineness of the horizontal or water lines, as shown in the Half Breadth Plan. It is said that the Penzance luggers are wonderfully dry in a head sea, and this they probably are, but they are particularly lively, and anyone unaccustomed to them can neither "stand, sit, nor lie down" in them. They have long easy lines; an almost perfectly balanced fore and after body; no weight in the ends; no heavy bowsprit, or boom, or rigging; and not a large weight of ballast to carry. The mast, it is true, is stepped rather far forward, but the absence of a bowsprit more than compensates for this, and whilst it may increase the momemtum acquired during pitching and scending, it does not cause them to plunge their bows under. A smaller class of lugger, built on the same lines, but about 30ft. on the keel, for the Pilchard fishing, are open in the middle, and only decked fore and aft. One of these boats went to Australia in 1848 with five hands for the "diggings." She called off the Cape and took the mails to Melbourne, actually beating the regular Packet, although off the Horn she had to make a raft or floating anchor of her spars to ride to during a heavy gale.

It is claimed that the Penzance luggers are capable of very high speed, and although they are not asserted to have done such wonderful things as the Yorkshire luggers have, there is no doubt that they are capable of attaining a speed equal to that attained by any other craft of similar length. The design we give (Plate XXIV.) is that of the Colleen Bawn, built at Penzance, by Mr. J. R. Wills, and she is declared to be the fastest lugger yet built in the west. It will be seen that she has about the length of load line of a racing 20-tonner, but has 5ft. more beam than any of that ilk has, and less draught of water. However the "Dewdrop," also built by Mr. Wills, could beat her in a breeze, although she was only 45ft. on the keel and had no counter. The Dewdrop was bought by Mr. T. G. Freke, and fitted up as a yacht. He gave her new spars and a couple of "lugs" which were of unusual size, the bumpkin outrigger for the mizen being 29ft. outboard; still there was not spread enough for the mizen, and a foot-yard was used after the fashion of the foot-yard to a balloon topsail. She had a mizen staysail and was very remarkable for her close-windedness.

The rig it will be seen, upon reference to Fig. 73 (page 226), consists of two lug sails, usually made of cotton and tanned with oak bark and catechu. The fore lug has to be dipped in tacking, but the mizen is a working one and requires no dipping, the tack being made fast at the mast. There is no rigging to either mast, beyond a burton to the foremast and a stay to the mizen. The burton is brought to windward of the mast with the tye-tackle.

The sails are seldom reefed, and they are made with only one reef band. When it is necessary to shorten sail, the mizen is shifted forward and a smaller mizen set; and this shifting goes on until the small "watch" mizen (used when riding to the nets with foremast unshipped) is reached. The boats are usually provided with the large fore lug, and three mizens besides the watch mizen. They cannot very well be hove to, and have to be kept "trying," or scudding; however, it must be a heavy gale that causes them to "up-helm," and then no craft of similar size afloat can excel them in running for the land.

The sail is hoisted by a chain halyard called a tye and a tackle or purchase, consisting of two double blocks, the fall leading from the lower block. The sheave hole at the masthead for the tye has only a "dead sheave," that is a half sheave fitted in the hole. The mast traveller is two half hoops jointed together by eyes, and they are said never to jam. The tack of the fore lug is hooked to the short bumpkin outside the stem head, but when the other mizen-lugs are shifted forward they are hooked to the stem head. The fore sheet tackle is hooked to an outrigger outside on the wales just abreast of the mizen mast.

The mizen stay tackle is hooked to a ring bolt in the centre of the deck.

The mizen sheet is fitted in this way (see Fig. 71): on the bumpkin* is an iron traveller, to the underside of which the chain sheet is attached; the sheet is rove up through a sheave-hole at the end of the bumpkin and hooked to the clew of the mizen. A block is hooked to the traveller, through which a rope is rove, one end being made fast on board. There are no stays to the bumpkin.

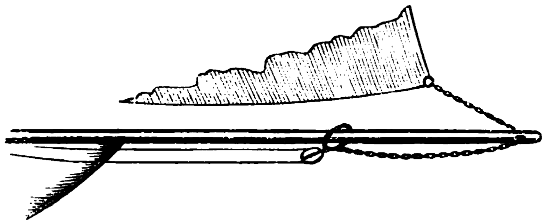


FIG. 71.

In tacking, the sheet is unhooked from the sail as the helm is put down; as the boat comes head to wind, the halyards are eased up and the after leech of the sail hauled down upon until the after-end of the yard or peak can be shifted round by the fore-side of the mast; the tack is never started. The sail is gathered in by the foot and leech and passed round the fore side of the mast. By not letting go the tack the fore part of the sail acts as a jib, and assists in paying the boat's head off. If the boat does not pay off readily, the foreyard is kept into the mast so that only the fore-part of the sail can fill, and the mizen sheet is let fly.

In the mackerel season, from February to July, they carry about one and a quarter mile of nets on the S.W. coast of Ireland. In the herring season, from October to January, they carry from half to three-quarters of a mile of nets on the S.W. coast of England.

When hauling or shooting the nets, rollers are fixed on the coamings of the hatchways and on the rail of the bulwarks, to enable the nets to run well and to prevent their being damaged. Before the net is shot over the side, a shoot rope is bent to the head of the net by stops. The stops are long enough to allow the shoot rope to lie about half way down the net. The use of this rope is to save the nets, should a vessel sail through and cut them. The boats ride to the nets by this rope.

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* Called outrigger in the West country.

The boats are usually manned by six men and a boy who are employed as follows: Two at the capstan getting in the net; one forward to cast off the stops of the shoot rope; two at the net-room hatchway to shake out the fish, and stow the net; one at the helm, and the boy to coil away the shoot rope.

It will be noticed upon reference to the Body Plan and Sheer Plan that the top of the keel, and *not* the load water-line, is the base line from which all heights are measured. All the sections shown in the Sheer Plan are therefore perpendicular to the base line or keel, and not to the load water-line. The curved lines shown in the Body Plan are the water-lines; they are set off in this way: in the Sheer Plan (Plate XXIV.) at No. 3 section, measure the distance from *h* to *i*; set off this distance on the middle line (*o*) of the Body Plan as at *j*, measured from the base line; then draw the ticked line *t* at right angles to *o*, and where this line cuts No. 3 section at *v* will be the spot for the water-line on that section. The points in the other sections will be similarly found, and, when complete, a line drawn through the spots will represent the water-line, and will be more or less curved.

No. of Section	1	2	3	4	⊗	5	6	7	8	9
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft in.	ft. in.	ft. in.
SHEER PLAN.										
Heights from top of keel to covering board...	7 0	6 11	6 10	6 10	6 10	6 11	7 1	7 5	7 10	8 6
Depth from L.W.L. to top of keel	3 5	—	—	—	—	—	—	—	—	5 4
BODY PLAN.										
Half-breadths at deck	1 9¼	4 2½	6 0	7 0	7 8	7 8½	7 8	6 11	6 4½	5 6
Half-breadths, *a* diagonal	—	—	—	—	—	7 10½	7 9	7 4½	6 4	4 4
Half-breadths, *g* diagonal	1 9½	4 3½	6 2¼	7 3½	7 6½	7 7½	7 4	6 6¼	4 11½	2 2
Half-breadths, *k* diagonal	1 7¼	4 1	5 9½	6 7½	6 9½	6 9½	6 1	4 10	3 2	0 9
Half-breadths, *m* diagonal	1 5	3 5¼	4 7½	5 1	5 0½	4 9¾	4 0¼	2 11½	1 8¾	0 4½
Half-breadths, *n* diagonal	1 0	2 3	2 9	2 10	2 8¼	2 6	2 0	1 4¾	0 9½	0 3

All the half-breadths are without the plank.

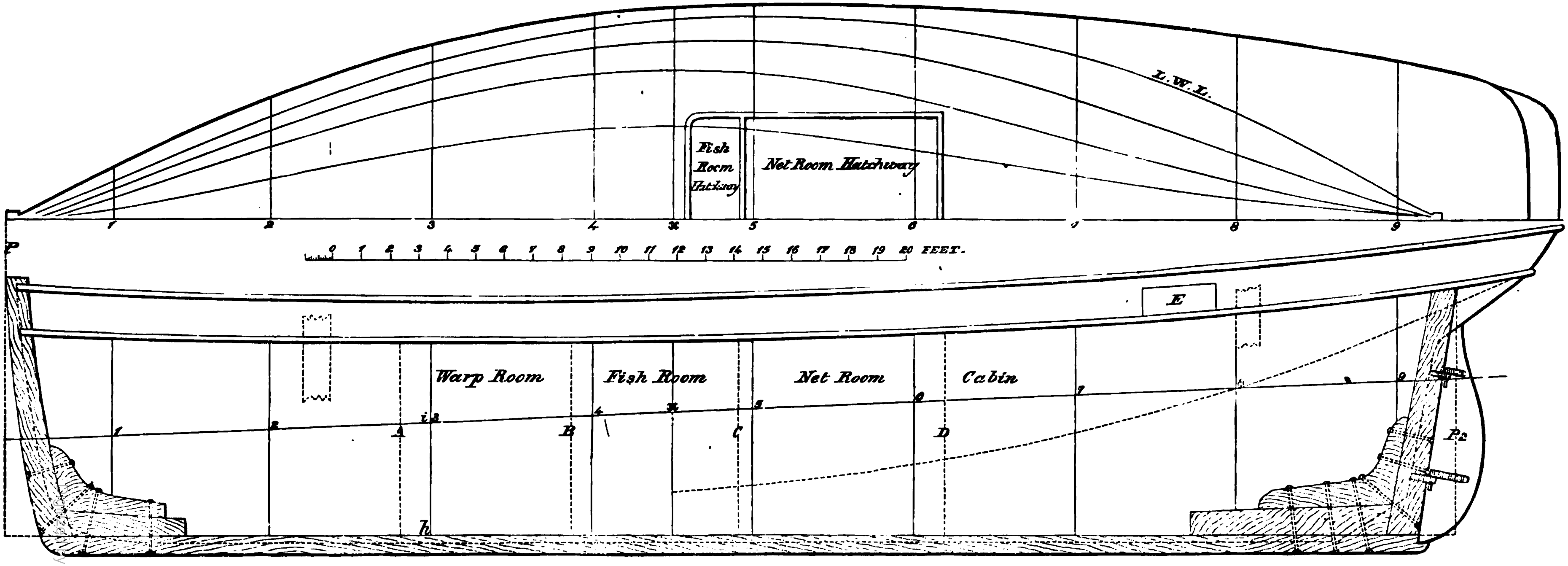
No. 1 section is 3ft. 8in. from the fore perpendicular P. The other sections are 5ft. 8in. apart, and No. 9 section is 2ft. from the aft perpendicular P 2.

All the half-breadths given are without the plank.

The water-lines shown in the Half-breadth Plan are 1ft. apart in the Body Plan.

Diagonal *a* is struck 9ft. above the base line, and cuts the perpendicular *p* 6ft. above the base line.

PLATE XXIV.



PENZANCE LUGGER.

Diagonal *g* is struck 7ft. 4in. above the base line, and cuts *p p* at *g* 1 and *g* 2 at 4ft. 9in. above the base line.

Diagonal *k* is struck 5ft. 11in. above the base line, and cuts *p p* at *k* 1 and *k* 2 at 2ft. 11in. above the base line.

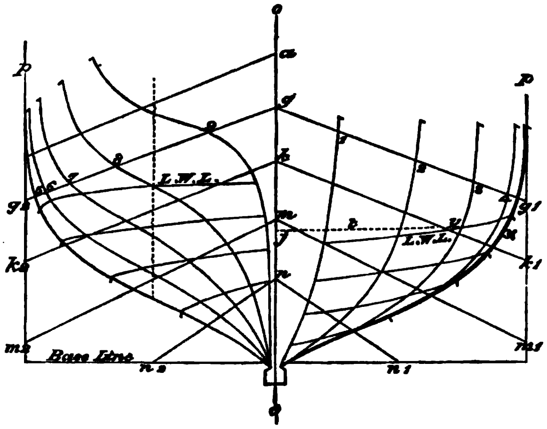
Diagonal *m* is struck 4ft. 2in. above the base line, and cuts *p p* at *m* 1 and *m* 2 at 6in. above the base line.

Diagonal *n* is struck 2ft. 5in. above the base line, and at *n* 1 and *n* 2 is 3ft. 8in. out from the middle vertical line *o*.

The midship section is midway between No. 4 and No. 5 sections.

The fore bulkhead A, forming the warp room (see Sheer Plan), is 13ft. 9in. abaft the fore perpendicular.

The bulkhead B is 6ft. from A, C 6ft. from B, D 7ft. from C; E is the companion entrance to the cabin.



Body Plan.

Fig. 72.

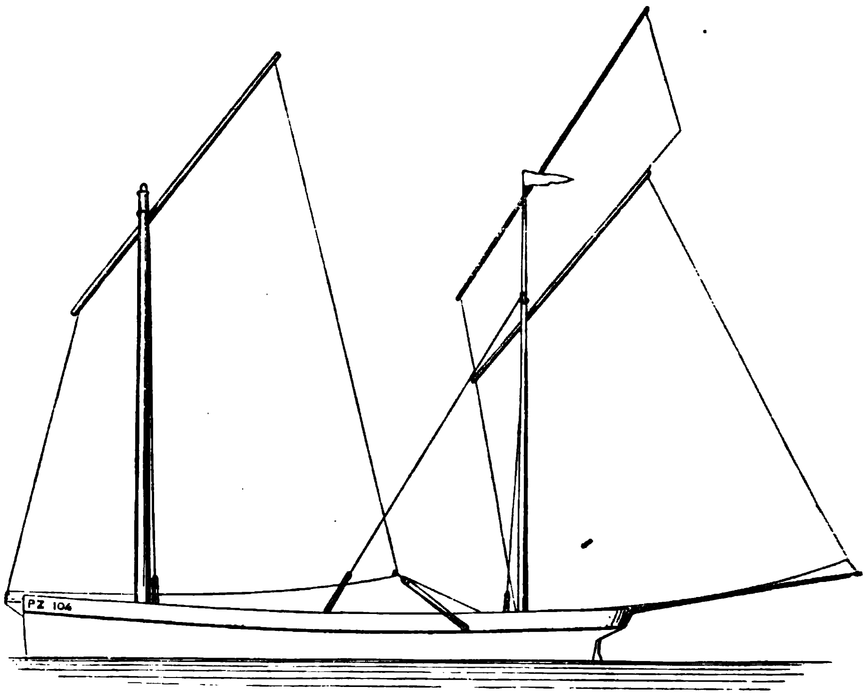
	ft.	in.
Length on deck, fore side of stem, aft side of sternpost	**51**	**0**
Length on keel	**48**	**0**
Rake of sternpost	**1**	**4**
Breadth, moulded	**14**	**7**
Breadth, extreme, with plank on	**14**	**10**
Draught of water, extreme	**6**	**0**
Mid-section ahead of centre of length of load line	**1**	**8**
Centre of buoyancy abaft centre of length of load line	**0**	**4**
Displacement to load water-line	**36 tons**	
Displacement per inch at load line	**1 ton 2cwt.**	
Tonnage, B.M.	**41 tons**	
Ballast	**14 tons**	

	ft.	in.
Siding of keel, stem and sternpost	**0**	**6¼**
Moulding (depth) of keel	**0**	**9**
Siding of frames	**0**	**4**
Room and space	**1**	**5**

In the drawing only every fourth frame or section is shown.

	ft.	in.
Fore mast, deck to sheave	**37**	**6**
Mizen mast, deck to sheave	**29**	**0**
Mizen mast, deck to topsail halyard sheave	**37**	**6**

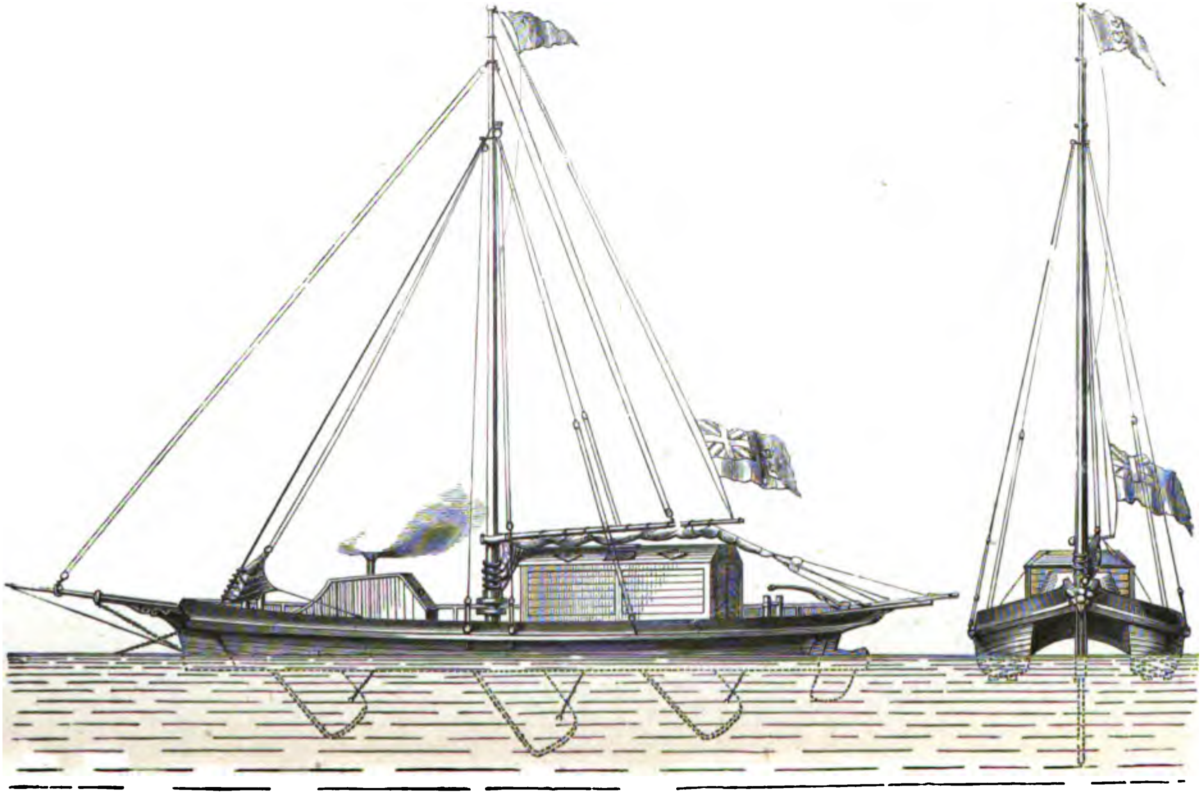
	ft.	in.
Mizen bumpkin, outside	20	0
Foremast, diameter at deck	0	11
Foremast, diameter at sheave	0	6½
Mizenmast, diameter at deck	0	10½
Mizenmast, diameter at sheave	0	6½
Fore tack bumpkin, outside	1	3
Luff of fore lugsail	26	0
Leech of fore lugsail	46	0
Foot of fore lugsail	34	0
Head of fore lugsail	28	0
Clew to weather earing of fore lugsail	36	0
Luff of mizen lugsail	20	0
Leech of mizen lugsail	41	0
Foot of mizen lugsail	29	0
Head of mizen lugsail	24	0
Clew to weather earing of mizen lugsail	36	0
Area, fore lugsail	980 sq. ft.	
Area, mizen lugsail	730 sq. ft.	



PENZANCE LUGGER.

FIG. 73.

PLATE XXV.



Melling's Safety Yacht.

CHAPTER XXII.

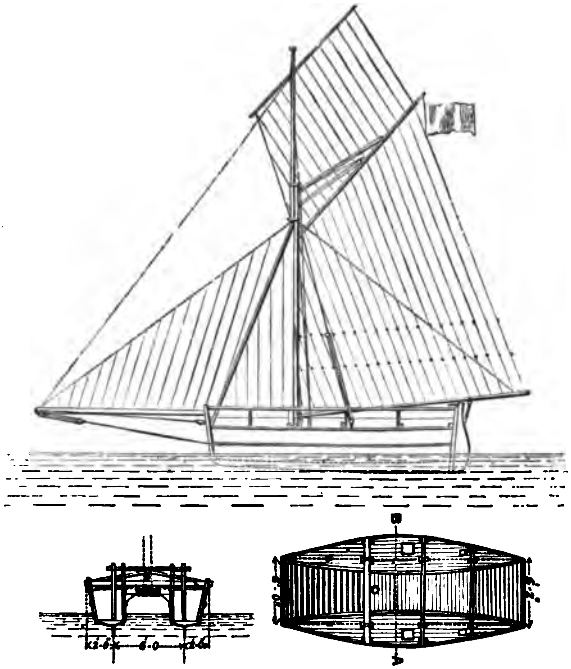
DOUBLE BOATS.

Double boats, in some form or the other, are met with all over the world, and the principle is adopted with the main object of acquiring great stability. But, although double boats may have in this way great stability, it must not be supposed that they are uncapsizable. They could be capsized by carrying a heavy press of canvas, or they might be thrown over by a sea, just as a lifeboat is sometimes.

In 1873, Mr. H. Melling, of Liverpool, had what he termed a safety yacht constructed on the double hull principle, as shown on Plate XXV. Mr. Melling thus described his boat: "The danger of stranding on a bank or foundering at sea may be considered as done away with; happen what may, *she never can sink!* for even if scuttled she will remain as a strongly-put-together life-raft, and navigable on the surface of the water, and her destruction will only occur by being dashed to pieces on rocks; but even then life may be saved. She is able to run over banks and shoals, cross bars, and make harbour when another vessel cannot approach, for she can *accommodate herself* to draw *only one foot of water!* although of the size of 15 tons. She sails *upright* and not on her side, for she requires only small spars, sails and rigging to sail her. She can be beached at pleasure without risk of straining, keep an upright position, and you may sleep on board without the annoyance of everything sliding, as well as yourself, to one side. In case of an extreme accident she will drive ashore over the surf, and you may jump on land without running the risk of being upset in a punt. She can be anchored and put into places out of the way of harm or being run down or afoul of, and ride to her anchor in a roadstead, light and buoyant, with little strain on her cable. All is of pine wood, light and buoyant in its nature, having *no ballast* whatever, and nothing but her own weight to support. She is capable of navigating the ocean as well as the shallowest of rivers, with comfortable cabin accommodation on deck, affording a good 'look-out' fore and aft. Galley and stowage berths are in the forecastle, and by a system of casks stowed away in the pontoons and on deck she will carry stores, provisions, water, &c., for a voyage, which as they are emptied and bunged up will add materially to her safety. Her points as a seagoing craft are peculiar, and some remarkable. In scudding before the gale she will not swerve from one side to the other, but keep a steady course, with little assistance from the helm; and, for the same reason and nature of her contrivance, will not 'broach to,' that most dangerous of calamities which may happen to a vessel. From superior buoyancy she is not liable to 'pooping'; but if a sea should board on the quarter it will make its escape through a grating aft, disappear, and leave her as buoyant as ever. The same protection is made forwards in case of a sea taking her there. The deck planks on each side are so constructed as to let the sea escape in case of a beam sea. She made very good weather of it in turning down the Dee and along the Welsh coast over shallows against a strong wind. In running back off the wind she attained the extraordinary speed of nineteen and a half miles an hour.

The use of the boards are as follows: if the fore board is down or part down, it makes her stay in a sea way; if the aft one be down it holds her steady in scudding, and prevents broaching to; if they be all down, she holds a good wind and makes no lee way. They can be let down partially or wholly as required by a chain, and can be hauled up by hand. They are weighted to sink by themselves, and house themselves as soon as she touches the ground. Her pontoons are 30ft. long and 2ft 6in. in diameter, representing enormous floating power; and, as it is almost unnecessary to say, water-tight pontoons or air chambers are the most powerful principle of buoyancy known. In the drawing her broadside view is given, with the submerged portion shown by dotted lines. The 'end-on' view more clearly shows the power of the vessel and the peculiarity of her construction."

In the spring of 1868 Mr. John Mackenzie, of Belfast, constructed a double boat, but without dropping keels. He thus described her: "There are two boats of equal size, each 21ft. keel, 3ft. beam, and 3ft. deep. Each boat is divided by bulkheads into four compartments, two of these being 6ft. 6in. long, so as to be used for sleeping purposes; a hatch is in one compartment and a movable skylight in another, which is also adapted for ventilation; these hatches are screwed down on indiarubber, and can be made quite air-tight. A keel is provided on each boat, 15in. deep at the stern or heel, diminishing forward to 6in. Bolted to the keel by strong iron knees are stanchions which rise through the deck, on which the rail is fixed; to these stanchions the cross-beams connecting the boats are fixed, the timbers or ribs also rising through the deck for a similar purpose, where the cross-beams are placed. The skin is 1in. thick, being in one board on either side of keel; the sides are in two, each 18in. deep, the seams being covered by a continuous strip of wood. By this method there are only four seams in each boat which require caulking, so that leakage is rendered nearly impossible. The boats are connected by five trussed beams, the one at which the mast is stepped being double trussed. A platform rests on these beams, a space of 3in. being left at either side to allow air compressed by a cross-sea to escape from underneath; from the mast forward this platform is formed of open-work. Immediately under the platform is a chest, 2ft. broad and 6in. deep, capable of carrying 6cwt. of water to serve as ballast in heavy weather. It is provided with brass valves in bottom, which in light weather or in case of accident can be opened, and the water discharged in a few minutes; when the box is emptied, by closing the valves a third chamber or boat is formed, capable of carrying 7 or 8cwt., in case the other two got waterlogged. It may seem strange to place the ballast in the position described; but this extra weight—which is absolutely required to enable the boat to beat up in a strong sea—makes her also stay with certainty and speed by its central



SECTION ON LINE A.B. PLAN OF DECK.

Fig. 74.

position. A boat of this description, no doubt, will carry her sail without ballast; but no craft with a very light draught will stay in a heavy sea without an additional weight to that of the hull and spars. A helm is attached to each boat, and these, being coupled together by a connecting rod, are worked by a tiller in the centre, so that both are moved in the same direction.

"The advantages that occur to me from this style of boat are, greater security, much more comfort, and capability of carrying a larger number of persons than would be possible in another boat of the same length. The great breadth of beam causes the boat to sail with less angles than is usual, and thus ensures greater facility for moving about the deck. It might be supposed that a boat so constructed would wet those on board very much; but this is not the case, as the buoyancy is so great that very few waves break over the platform. Those that do come on board, being principally in front of the mast, disappear through the open-work before mentioned. When on a cruise and lying at anchor, a waterproof tent can be rigged up on deck, in which there will be a clear inside space of 8ft. by 6ft., sleeping berths being provided for four persons in the boats as before mentioned. A permanent cabin on deck is in my opinion very objectionable, as it interferes with the working of the sails, and is a serious hindrance to beating to windward. I had various opportunities during the last two summers of testing the qualities of this boat. The best opportunity was afforded during last summer by a cruise along the Antrim coast, and by frequent sailing in the Irish Channel, sometimes in half a gale of wind. I always found her to stay well, and go to windward in a very satisfactory manner. The greatest speed attained was ten knots an hour. During the summers of 1868 and 1869 she was moored in the centre of Bangor Harbour (which is a tidal one), without any trouble. When the tide ebbs the boats sit down on an even keel, and I consider it a great advantage to be able to run into harbour at nearly any state of the tide, as it takes away the risk of mooring in an exposed bay; or if running for shelter, you are much more likely to be able to enter a harbour than with an ordinary boat."

CHAPTER XXIII.

SEAMANSHIP.

Seamanship comprises the practice of the whole duties of a sailor, including rigging, steering, making sail, taking in sail, reefing, working the ship, heaving the lead, and whatever else relates to the management of a ship. Before a man can be called a seaman, he must have practised all these duties, and be capable of performing them in a satisfactory manner without supervision; he is then called an able seamen, as distinct from an "ordinary seaman," who is a young sailor not yet versed in the practice of the seaman's art.

To Set the Mainsail.—Take the coats off. Hook on the peak halyards. Overhaul some of the main sheet, and belay on both quarters. Top the boom up five or six feet clear of the crutch, taking care that the crutch is not lifted out of the sockets, and dropped overboard. When the boom is topped up,* haul the main sheet taut, and belay. Cast off the tyers or gaskets, leaving one as a "bunt gasket" amidships at present to keep the sail from blowing out. See that the purchases have been well overhauled (fleeted); and that the peak downhaul and the topsail sheet are rove. Man the peak halyards, cast off the bunt tyer, and hoist the gaff end between the topping lifts, guiding it with the peak line. When the gaff shows above the lifts, hoist away on the main, and let the sail go up with the gaff as nearly as possible at right angles to the mast. If the sail is peaked before the throat is up (*i.e.*, if the peak of the sail goes up faster than the throat), it will be hard work getting the throat up, if it can be got up at all. Get the throat as high as possible with the halyards, and belay. Leave the peak for the present, and pull the sail out on the foot by the outhaul. Purchase up the throat as high as required, and set the peak up, using the purchase until the sail begins to girt in the throat; a few girts here will not matter, as the peak will be sure to settle down a good deal. Sometimes, after the throat is set up hand-taut, the peak is got as high as it can be without the purchase. The sail is then set up by the main purchase, "peak and all" going up bodily. With a laced sail the tack is always lashed down to the gooseneck of the boom, and the main purchase brings the luff of the sail taut—like a bar of iron. When the sail is not laced (it is generally not so laced in a cutter), the tack-tackle is generally hooked on after the peak is up, and the luff of the sail is brought taut by this tackle. But the better plan is to make the tack fast before hoisting, but not until after the sail has been pulled out on the foot; it will be found that the main (throat) purchase will get the luff of the sail much tauter than the tack tackle can. We are speaking now of setting the sail to the best advantage; but it is quite possible that the skipper may want the tack triced up, for which purpose the tricing line will be hooked on to one of the mast hoops near the throat, and to the tack cringle of the sail.

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* It is a practice in racing vessels to unhook from the boom what is to be the lee topping lift, so that in hoisting the mainsail will not girt across it, and thus cause a delay in getting it up.

When the sail is set, the tyers should be made up in neat bunches, and the sail coats should be rolled up ready for stowing away in the sail room.

It is the practice to always have one reef earing rove, and if the weather looks at all threatening a second one should be rove.

If during sailing the peak should settle down so much as to require setting up, the best time to choose for doing so will be when the vessel is in stays. The weight of the boom should be taken by the topping lifts.

In bending a new mainsail great care should be taken not to get any strain on the head or foot at first. In hoisting set the throat halyards taut, and then get the peak a little more than half up. Then set the luff taut with the tack tackle, and afterwards set the peak up hand taut. If the weather is damp and any strain comes on the foot, ease up the outhaul. So also if the sail is set and it should rain, ease in the traveller. It is a good plan to thus hoist the sail up several days before getting underway, and as it blows about with the sun upon it and head and foot slack, it will stretch fairly. After a few days the head can be hauled out fairly taut, and the foot as well, but the traveller should always be eased in for rain or dew. And even for an old sail the traveller should be eased in a little if the sails gets wet, and if it appears necessary the tack or throat purchase should be eased as well.

To Reef a Mainsail.—Get the reef tackle on deck and bend it to the reef pendant or earing (previously rove), and hook the fore block to the eye bolt or strop on the boom. Top the boom by the weather lift, and ease the main sheet, if required, to allow the boom being lifted. Cast off the main tack, if the sail be not a laced one. Ease up the main and peak purchases till the sail has settled down a reef, and if necessary ease up the halyards by the fall. Put plenty of strength on the reef tackle (ease the helm a little, so as to take the weight of the wind out of the sail) and harden the earing down on the boom until the last inch is got. Then roll up tightly and neatly the foot of the sail, and tie up the reef points (*see* Fig. 75); set up the throat by the purchase, and then the peak. Bowse the tack down. Ease up the topping lift and trim the sheet. A racking should now be put on the earing, and the reef tackle cast off. Then make the earing fast by jamming turns round the boom. Reeve another earing and hook the tackle on to haul down the second reef if necessary. Never reef a new mainsail if it can be avoided.

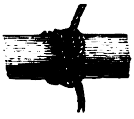

FIG. 75.

TO SHAKE A REEF OUT.—Ease the sheet and set taut the weather topping lift. Untie all the reef points, and be careful that not one is left tied, as the sail may be torn thereby. Ease up the tack tackle and unhook it. Ease up the reef earing. The reef will now be fairly shaken out, and the mainsail can be set by the purchases, always recollecting to set the throat up first. Bowse down the tack, ease up the topping lift, and trim the sheet.

TO STOW A MAINSAIL.—Put the tyers at proper intervals across the boom. Ship the crutch. Set taut the topping lifts. Overhaul main and peak purchase. Lower the boom by the topping lifts into the crutch. Haul taut the main sheet, cast off the falls of main and peak halyards, and lower (by the main the faster) and gather in the sail on deck. Belay the peak halyards so that the gaff end is clear of the boom. Lay the leech of the sail along the foot on the boom; take hold of the under part of the bag of the canvas, shaking up until the sail is in a snug bag formed by the last few feet of its foot; lift the sail up on the boom. Throw the ends of the tyers over the gaff, and haul up the sail snug to the gaff; then take the ends of the tyers under the boom up over the gaff again, and tie. Unhook peak halyards and put on the mainsail covers. The peak halyard blocks can be then hooked on again, or hooked to a sling passing under main boom, and will thus keep the boom from sagging with its own weight.

TO STOW THE MAINSAIL AND SET THE TRYSAIL.—In heavy weather it is always better to set a trysail than a close-reefed mainsail, as the mast is thus relieved of the heavy strain of the main boom and gaff. Get the trysail gaff clear of the other spars on deck. Get the trysail up, and the trysail sheets. Ship the boom crutch. Set the topping lifts taut. Overhaul the main and peak purchase. Settle the main boom down into the crutch. Haul the sheet taut and belay. Stow the mainsail and make it up on the boom. Put a lashing on the boom from each quarter, or secure the boom in the crutch by tackles on to each quarter. Take off main and peak halyards and hook the same to the trysail gaff. Unhook the topping lifts, and make them fast in main rigging. Lace the trysail to the gaff. Bend the sheet and belay both hand-taut. Hoist and toggle on the parrels, or strops, or lace as the sail goes up.

To Set a Stay-Foresail. (In a schooner this sail is termed the fore staysail, and the foresail is the gaff sail set abaft the foremast; in cutters the foresail, although as in a schooner set on the forestay, is simply termed the foresail or staysail; the proper term is stay-foresail).—Take off the coat and hook on or bend the sheets, hauling in slack of port or starboard one (or both), and belay. See that the downhaul is bent, and hoist away. When the sail is high enough, hook on the tack tackle and bowse down.

To Reef a Stay-Foresail.—Cast off the tack tackle and lower the sail; unhook the sheets; tightly and neatly roll up the foot of the sail and tie the reef points. Hook on the sheets to the reef cringle and belay; re-hoist the sail; hook the tack to the reef cringle and bowse down with the tackle.

To Shift a Stay-Foresail for a Ballooner.—Let go the halyards and haul down by the downhaul; unhook the halyards from the head cringle; hook them on to the balloon foresail with downhaul; and, as the sail is hoisted, toggle the luff on to the forestay, or hook on as the case may be; carry the lee sheet aft and belay (slack) as the crew start hoisting. When the head is chock-a-block bowse down the tack. Trim the sheet. On a wind the sheet is generally brought inside the main rigging, or between the main rigging and the topmast backstays. For reaching, the sheet is carried outside of all.

To Set a Jib.—Carry the sail forward tack first. Hook the tack cringle to the traveller; hook on the halyards and downhaul to leeward of the foresail; belay the sheets hand-taut, or one a-weather, as required. Hoist away by the halyards until the sail is about half up; then haul the tack out by the traveller outhaul, hoist the sail and set taut with the purchase. Trim the sheets. Always be careful that the jib sheets are rove through the right holes; nothing shows up the careless mate so much as the sheet for first jib rove through the holes for second jib, or the contrary.

In light winds it will be found less trouble to pull the jib out on the bowsprit before hoisting, and with a few stops uncut.

Generally in getting under way the jib is set up in stops, that is, before it is unrolled. The jib is hoisted up some distance, and then the tack is pulled out on the bowsprit, the sheets being loose, as otherwise the stops would be broken. Upon getting under way the stops are broken by hauling in the jib sheets.

When the second or third jib is set the bowsprit should be reefed, and double-reefed for third jib; otherwise the strain from the jib may cause the bowsprit to break, as the strain would come far inside the support of the bobstay, and "nip" the spar.

Before purchasing up a jib the runner-tackles should be always set taut, and, if necessary, swigged upon. If the runners are slack, the effect will be to pull the mast forward instead of to straighten the luff of the jib. It is also necessary that the bobstay should be set well taut by its tackle.

To SHIFT A JIB.—Ease up the purchase, slack up the outhaul and pull in by the inhaul, and gather the sail in board by the sheet and foot; pull the head of the sail down by the downhaul, still gathering the sail in-board by the foot. The purchase should always be eased before the outhaul is let go. If the outhaul is let go first, the jib will fly in, and cause such a jerk that the bowsprit might be sprung or the bobstay burst.

If possible, the jib should be shifted when the vessel is before the wind; and often a sailing master will run his vessel off whilst the crew are getting the jib in, so that the sail is becalmed. Sometimes two or three or more hands go on the bowsprit, and gather the sail up as it comes down, but in bad weather the traveller is always let run up close to the stemhead.

In light weather, if it is seen beforehand that one jib will have to be shifted for another, that other can be stopped along the bowsprit, and the tack lashed to the end; then when a shift has to be made, the other jib is lowered and sheets unbent. The halyards and sheets are then bent to the other jib, and the jib hoisted, always taking care that the sheets are *over* the jib that lies on the bow, and not under. The jib just lowered can be stopped along the bowsprit; then in case there has to be a shift back, it will be already on the traveller and hauled out ready for hoisting. Haul taut the weather sheet; one hand cut the lashing at the bowsprit end; as the jib flies aft haul in by the mainparts of the sheet, and pull down by the downhaul. Hook the halyards, downhaul, and sheets on the other jib and hoist away.

Sometimes a start is made with the jib tack cringle lashed to the bowsprit end; in which case the next jib for shifting is hooked to the traveller, hauled out, and stopped along the bowsprit, in readiness for hoisting when the time comes.

To SET A GAFF TOPSAIL.—Bend the sail to the yard; lace the weather earing first, and then haul the head taut along the yard, and lace the peak earing through and through. Tie the stops round the yard, or lace, as the case may be. Bend the sheet to the clew cringle (*see* Fig. 76). The upper part, *a*, is the extreme end of the sheet. Or the sheet can be bent as shown by Fig. 77, the end being stopped back on the standing part. See that the sheet is inside the topping lift, and that it passes under the yard from the mast side before it is bent to the clew cringle. See that the clew line is fast to the clew cringle. Hook on the halyards and bend the trip halyards (*see* Fig. 78), and hoist the sail clear of the deck. Hook on the tack tackle, and put a mousing on the hook.

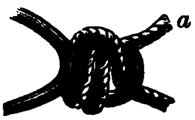

Fig. 76.

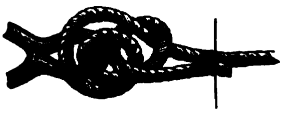

Fig. 77.

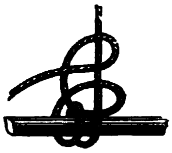

Fig. 78.

To keep the sail from blowing away from the mast, it is usual to have a "lazy tack," which consists of a short line, one end of which is fast to the tack cringle of the sail; the other end is passed round that part of the main or peak halyards which has been belayed to the mast bitts, and is then made fast to the tack cringle; the line thus forms a kind of traveller, and the main or peak halyard serves as a jack stay.

A gaff topsail should be always sent up to windward, and if the halyards are to leeward they should be shifted over.

Hoist on the trip halyards until the peak is well up inside the topping lift (the peak will always be the aft end of the yard), then hoist away on all, overhauling the sheet as the sail goes up; otherwise, if the sail blows about, the sheet may get a turn round the gaff end. When the yard is so high that the point where the trip halyards are bent is level with the trip halyard sheave in the topmast, leave the trip halyards adrift, and all hands hoist by the other halyards. When the yard is chock-a-block, belay. Bowse down the tack to the last inch, and belay. Set taut the trip halyards. Pass the lacing and haul taut round the masthead. Haul out the sheet until the sail sits as desired. A topsail should never be sheeted until the tack has been bowsed down. If during sailing it is found that the tack requires bowsing down, the sheet should be eased up first.

Before the topsail is sheeted, a look should always be given to the topmast stay. The topmast should cant forwards a trifle, so as to insure plenty of drift for the sheet.

If the head of the sail be very short, the trip halyards will not be used.

In the case of a jib-headed topsail, the same precaution must be observed in bending the sheet by passing it under the sail from the side next the mast. The sail will be hoisted as fast as the masthead-man can lace it.

In running before the wind with the boom square off, the topsail sheet should be eased a little, and, if necessary to relieve the strain on the weather cloths, the lacing or tack should be eased as well.

To TAKE IN A GAFF TOPSAIL.—One hand will go aloft to cast off the lacing. When all is ready for lowering, cast off the halyards and trip halyards from the belaying pins. Ease up the tack tackle; but do not cast off the "lazy tack." Lower away by the halyards, but keep the trip halyards hand taut, until the yard is " up and down " the mast. Ease up the sheet, and lower away all. If there be much wind, several hands must be put upon the tack to haul down, as the belly of the sail is certain to blow in between the parts of the peak halyards, and will thus prevent the sail lowering. The hand aloft will keep the heel of the yard inside the topping lift as it passes down.

As the yard comes down between the topping lift and the mainsail, haul forward by the tack (casting off lazy tack), so that the heel of the yard (the lower end) goes forward.

When the sail is on deck, unbend the halyards and make the ends fast to a belaying pin. Unbend the sheet, and make it fast round the boom. Roll the sail up on the yard; or unbend it, roll up, and stow below.

Formerly the practice was to lower the topsail to leeward of the mainsail, as it was thought to come down more freely under the lee of the lower sail; but the difficulty is that the sail or yard is almost certain to get foul of the topmast rigging or lee crosstrees, and the crew cannot handle it so well from the lee scuppers. Very often in attempting to take in a topsail to leeward it will take charge and blow out, whereas if it were to windward it would lie flat on the mainsail, and could not blow away. So now the practice is, if the tack be to leeward, for a hand to go aloft in the lee rigging or up the mast hoops and unhook the tack tackle, whilst another hand goes aloft on the weather side to the masthead, and lowers a line to him to bend to the tack. When the line is so bent, the hand at the masthead pulls the tack up over the peak halyards, so that the sail can be got down to windward. The heel of the yard is pushed to the weather side of the mast.

To SET A SCHOONER'S FORE GAFF TOPSAIL.—The sail should be sent up stopped to the yard, with the clew and tack cringles clear. Bend on the halyards, and hoist to the masthead. The hand aloft will then bend on the lee sheet and lee tack to the cringles; then the weather sheet and tack will be bent, first passing them over the maintopmast stay. When this is done, hoist the sail chock-a-block, bowse down the lee tack, then sheet home by the lee sheet on the winch.

To Work a Fore Gaff Topsail.—When the order comes "ready about," ease up the sheet and tack; clew the sail well up. The foremasthead man will clear the tack and sheet over the maintopmast stay, and must well overhaul the same. As the vessel comes head to wind, bowse down the tack as smartly as possible, at the same time haul out the sheet; but do not sheet home until the topsail is tacked, as it must always be recollected that a topsail cannot be properly set until the tack is down.

To Set a Jib Topsail.—Pass along the sail head first, one hand going to bowsprit end with the head cringle in his hand. In large vessels this hand bestrides the bowsprit outside the top-mast stay, with his face towards the vessel; generally in such small vessels as five-tonners there is not such a "seat" at the extreme end, and the hand will sit on the bowsprit shrouds if the sail has to be hanked. Haul in the lee sheet, and place one hand to attend to it, and ease up if necessary. Hook or toggle the hanks on to the topmast stay, cutting the stops and hoisting as the hanks are so hooked or toggled. When all the hanks are on, hoist to the required height, set the tack down, and trim the sheet. A jib topsail in a five-tonner is generally set flying, as the bowsprit-end of such small craft is not a pleasant place for a man of the customary weight of eleven stone. At the bowsprit-end a tail block is fast; through this block a rope is rove, both ends being kept in-board. To set the sail, bend both ends of this rope to the tack cringle, and bend the halyards to the head cringle. Haul the sail out on the bowsprit by the *under* part of the outhaul, and hoist at the same time. The bight of the outhaul will, therefore, come in-board, and its *upper* part will serve as the inhaul when the sail has to be handed. The sail can be hoisted to any required height. In strong winds a jib topsail should never be hoisted so high as in light airs, as the higher it is the more strain it will bring on the topmast.

To Set a Main Topmast Staysail.—See that the halyards are on the lee side of the main-topmast stay. Bend on the halyards, tack and sheet; see that the sheet has been passed outside the main rigging and main-topmast rigging. Hoist to foremast head in a bunch; then, as the hand aloft hooks the hanks on the main-topmast stay, the deck hands will hoist. When hoisted, set the tack taut, and belay. Trim the sheet. It is very usual for the sheet to lead to the boom end; it cannot very well be got too far aft.

To Set a Squaresail.—The yard has a strop and thimble eye seized in it at the centre of length of yard; on the fore side of the mast a wire jack stay or jumper reaches from masthead to deck, on which the thimble eye on the yard strop travels. The braces are rove through single blocks at each yard arm, and one end made fast to the cavel aft, the other part is for hauling. The fore braces are single ropes leading from each yard arm through single blocks at the bowsprit end. The lifts go from each yard-arm through single blocks hooked to the upper cap at masthead, and lead to the deck. When at anchor the yard is generally lowered half-way down, and then pointed up and down the mast. It is more ship-shape, however, to lower the yard down to about level with the tier of mast hoops and square across, with all the braces and lifts set taut. The only objection to the latter plan is that it may be fouled by passing vessels.

To set the sail, reeve the earings through the block at each yard-arm, and through a block near the strop on the yard amidships; then hoist the yard up. Bend or hook one end of each earing to the corner head cringles of the sail, and hook the fore halyards to the middle cringle; hitch the lizard to the cringle or hook of halyard block. (The lizard is a short piece of rope with an eye at one end; the eye travels on the jumper, and the tail is fast to the sail; thus the sail is kept from blowing away.) Bend on the tack and sheet; then hoist by the halyards, and afterwards pull out the weather earing; take in the slack of the lee earing. Get out the boom with fore and after guys on it, and the outhaul rove through the sheave hole at boom end; bend the outhaul to the tack cringle of the sail, and haul out.

To take in the sail, let go the weather and lee earing; then let go the sheet, and tack outhaul, and gather the sail aboard; then, when the sail is all in-board, let go the halyards and haul down with downhaul. As the sail is hoisted by the foresail halyards, the fore downhaul will be used as well.

To Set a Spinnaker.—The boom must be got ready first. Reeve the outhaul in the sheave hole or block at the spinnaker boom end; put on the after guy and fore guy; bend the lower block of the topping lift to the boom (it is usually a tail block). Hoist the boom well above the rail, and launch forward until the gooseneck can be shipped in the socket. (It is usual to put the gooseneck in the socket on the mast first, and then bring the square socket in the end of the boom to the shank—*see* Fig. 79—*c* is the boom and *p* the gooseneck, *a* the mast.) Top the boom a little more and haul aft, or "square the boom." If the boom be already shipped and "up and down the mast," one or two hands will take the guys aloft and put over the end. The standing part of the after whip will be made fast to the quarter, and the

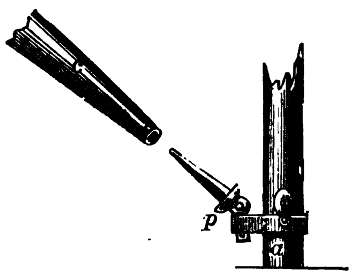

Fig. 79.

hauling part rove through a sheave hole or turned round a pin. The hand aloft will cast off the boom lashing, and push it away clear of mast and crosstrees for lowering by the topping lift.

Bend on the halyards and the outhaul to the sail. If the spinnaker is to answer the purpose of bowsprit spinnaker as well, another outhaul must be bent. Generally the fore guy in such cases is made to do duty for this purpose; but if there be a fore guy beside the tack outhaul, care must be taken in bending the latter to see that it is *over* the fore guy, and not *under*. Bend on the sheet and belay, with one hand to attend to it to ease up if necessary. Hoist away on the halyards, and when the sail is up chock-a-block put all hands on the outhaul, easing up the sheet all that is necessary, so as to make the sail lift in order that it may be boom-ended; drop the boom down and trim the sheet. In racing, the sail is very frequently pulled out on the boom whilst it is being mast-headed. This is all very well if there be plenty of help at hand, and if there is not much wind; but generally, if the sail be hauled out on the boom first, it is found almost impossible to get the head up chock-a-block. To prevent the sail going up full of turns, there is a swivel at the head, but this will not always prevent turns, as the swivel is likely to jam; and a good plan is for a man to stand by the mast and run the leech of the sail through his hands as it goes up.

To Take in a Spinnaker.—Top the boom up, well clear of the rail, so that when the sail is taken off it will not drop into the water. Take hold of the foot of the sail, let go the outhaul, and haul the sail in smartly by foot and sheet; gather the sail in to the mast and then let go the halyards, and haul down.

The halyards should never be started until the sail has been hauled in-board from the boom; if the halyards are started first, and there be much wind, the sail is almost certain to blow away and then get into the water, and cause a great deal of trouble.

To Set a Spinnaker on the Bowsprit.—Bend on the tack and halyards to leeward of jib and foresail; hoist and pull out by the outhaul; trim the sheet; take in the jib, or let it run down by the head and stop along the bowsprit.

To Take a Spinnaker in from the Bowsprit.—Pass the weather sheet round the fore stay to leeward; let go the outhaul, and haul the sail in-board smartly by the weather sheet and by the foot over the lee bow. In strong winds it will be sometimes necessary to let the sail fly in by cutting the tack adrift. In such cases the best plan, if there is only one sheet, is to bend a line to this sheet, with a running bight in it. Take this line forward, and haul the bight close up to the clew cringle of the sail. One hand will go out on the bowsprit and cut the tack (outhaul), which of course will unreeve. As the sail flies aft, smartly haul it in-board by the line that has been bent round the sheet, and get hold of the foot as soon as possible; gather the sail together, so that it cannot blow out whilst the foot is held; lower by the halyards, and haul in handsomely.

It should be clearly understood that the halyards must not be started until the sail is gathered together; and as fast as the sail blows out "spill" it by gathering the folds together, or it may take command and blow away, and perhaps at the same time pull someone overboard, or foul the lee crosstrees and be torn.

TO SHIFT A SPINNAKER BOOM.—Man the topping lift and hoist away. Slack up the fore guy, ease up the after guy as required, and do not let the boom swing forward. When topped carry the after guy and whip forward, passing it outside runners and rigging. Top the boom until it is lifted clear out of the gooseneck; lower by the topping lift, whilst three or four hands take it by the heel and carry it aft on the side of the mast it has to be next used. When sufficiently low and far enough aft to admit the upper end going under the fore stay, launch forward again and hoist away; ship the gooseneck as before, and reeve the guys. Sometimes, where the forehatch is near the mast, as in small vessels, the heel of the boom is lowered into the forecastle; this, of course, is a simpler plan than launching the heel of the boom aft. If handled with care, the heel of the boom can be lowered over the side.

TO SET A RINGTAIL.—In the first place, an iron hoop has to be fitted at the boom end (similar to the upper cap at masthead) to take the boomkin. One hand must get on the main boom. Bend the main peak downhaul to the boomkin (generally called ringtail boom), and hoist it to the main boom; steady it through the iron at the main boom end; cast off the peak downhaul; reeve an outhaul through the sheave hole in the end of the boomkin, and launch the spar the required distance out; then lash the heel to the main boom. In reeving the outhaul, care must be taken that the hauling part only is outside the topping lift. The head of the ringtail is bent to a yard, with three or four spare feet for inner end. Bend the main peak downhaul to this yard for a halyard; bend both ends of the downhaul to the tack cringle (the clew cringle for the sheet will be in-board). Hoist the sail, then pull out to boomkin end by the under part of the downhaul, and sheet as required.

To take this sail in, the first thing to do is to haul it in by the sheet and inhaul whilst the outhaul is slacked up. Lower by the halyards as fast as the sail is gathered in. The boomkin will be got on board by aid of the peak downhaul.

To Send up a Topmast.—Lash a tail block to the upper cap at masthead; through this reeve a rope and bring down to deck; reeve an end through the sheave hole in topmast and make it fast some distance below the shoulder, stopping the end securely. (The heel of the topmast should be aft.) Hoist away; point the topmast through the lower cap; then make the heel rope fast to topmast, cast off the other rope, and hoist the topmast up through the upper cap by the heel rope. Put the eyes of the rigging over the pole, topmast stay over all; reeve the halyards, lash on the tail blocks for jib-topsail and spinnaker halyards, and then send up the topmast by hauling on the heel rope and fid. Set up the backstays by the tackles.

The topmast will be sent down by reversing the order given above.

To House a Topmast.—Ease up the topmast stay and back-stay falls. Hoist away on the heel rope until the topmast is sufficiently above the lower cap for the hand aloft to unfid. Settle down the topmast by easing up the heel rope. When lowered, so that the eyes of the rigging come close to the cap, belay the heel rope and lash the heel of topmast to the mast. Unshackle the legs; hook the tackles on again in, and set hand-taut.

If the vessel has much list, the topmast will not come down very readily, and the weather backstays should be kept taut, so as to keep the topmast in the line of the mast, and to prevent it breaking. Also if there be much sea it may be found necessary to steady the topmast by the preventer. Generally the vessel should be eased or hove to whilst a topmast is being housed if there be much wind and sea.

Plans for fidding and unfidding topmasts from the deck without going aloft are given on page 104, but the following plan, in use among the South Coast fishermen, is as good as any: *a* is the heel of the topmast; *y y* the lower cap or yoke; *s* an iron fid loaded at one end, and pivoted in the centre; *m* and *n* are diagonal slots for the fid to work in; *k* is a small line passing through a hole in the heel of the topmast, and made fast to the fid. When the topmast is sent up the line *k* is kept taut, and when released the weighted end brings the fid into the position shown.

To unfid: hoist up by the heel rope, and pull on the small line *k* till the fid is canted in the slot *m* and *n*. The topmast can then be lowered.

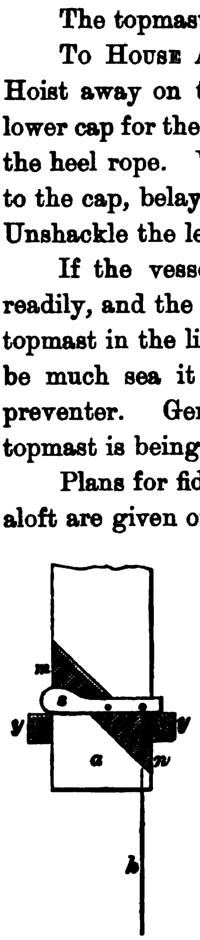

Fig. 80.

To Reef a Bowsprit.—If the jib is set, ease up the sheets and belay them, well slack. Cast off the bobstay fall and the falls of the shrouds and topmast stay. Knock out the fid, and then launch the bowsprit in by the shroud tackles; fid and set up all the tackles.

To take a Reef out of the Bowsprit.—Overhaul all the tackles; launch the bowsprit out with heel rope and tackle, or by the rack-plate and wheel; set the tackles taut again.

In setting up the bobstay tackle, it is usual in racing yachts, before starting in a match, to set the bowsprit end down until it nearly touches the water.* This is done in order to give more hoist and drift for the jib, as by frequent setting up the blocks would soon come "chock-a-block;" moreover the bobstay fall is certain to "come up" or stretch a good deal, so much so that very frequently at the end of a match a bowsprit, instead of being bent downwards, is steeved in the air.

To get under Way riding Head to Wind and Tide, to run before the Wind.—Heave short; set the jib in stops; take the foresail coat off and hook on the sheets; top the boom and cast the gaskets off the mainsail. To cast to starboard, put the helm to port, heave the anchor up smartly; as the anchor is a-weigh break out the jib and set the foresail, keeping the port jib and foresheet taut. As her head goes off set the mainsail, steady the helm, and trim the sheets.

To get under Way riding Stem to Tide with Wind astern to run before the wind.—Heave short; loose the mainsail; set, jib and foresail; break out the anchor, and when a-weigh set the mainsail.

To Get under Way Riding Head to Tide and Stern to Wind, to Beat to Windward.—Heave short; set the jib in stops, and hook on the fore sheets. To cast to port: put the helm to starboard, heave up the anchor; break out the jib, set the foresail (with starboard sheets hauled flat), and smartly set the mainsail. If the mainsail is set before the anchor is a-weigh, the peak should be dropped down.

To Get under Way when Riding Head to Wind and Tide by Casting to Starboard, to proceed on Port Tack Close-hauled.—Heave short; set the jib in stops; hook on the fore sheets with the port one fast. Set the mainsail. Put the helm to port, and heave up the anchor. As the anchor is a-weigh break out the jib with port sheet hauled a-weather. Slack off the mainsheet. As the vessel's head pays off let draw the head sheets, haul in mainsheet and sail her.

To Get underway; riding Head to Wind and Tide, by Casting to Port to proceed on Port Tack.—Heave short; set the jib in stops; bend on the fore sheet, with starboard one fast. Set the mainsail. Put the helm to starboard, get the anchor, break out the jib hauling starboard sheet in; ease off the main boom a little on the port quarter; keep the helm to starboard till the vessel's head wears off so as to bring the wind on the port quarter; the main boom will then gybe over; trim the sheets, and sail the vessel. It may sometimes be advisable not to set up the peak of the mainsail until after the vessel has wore round. In the case of a yawl the mizen would be set to get under way with, and not the mainsail.

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* Although no doubt this is a convenient way of allowing for the stretching of the fall of the bobstay, yet is it attended by some risk to the bowsprit. The spar is bent until it nearly reaches its breaking point, and if any further strain comes upon it, as there might whilst driving into a head sea, the bowsprit is in great danger of being broken; or if the shrouds and tackles should stretch badly, as they sometimes will, the bowsprit would most likely break. The best plan is to set the bowsprit gear up so that there is neither a downward nor upward curve in it, and there should be as little stretch as possible in the gear.

To Get under Way and Leave an Anchorage to Run for it.—If possible choose slack water time or when the tide is running to leeward. Set the trysail, reefed foresail and fourth jib. Watch for "smooths" to heave up the chain; but, if the sea is so bad that the vessel pitches head and shoulders under, so that there might be danger in pinning her down by heaving short, or if she sheers about so as to get the cable jammed hard athwart the stem, then unshackle the chain, make fast the buoy rope outside the hawse pipe, wait till the vessel sheers the way she is wanted to cast, then slip the chain and sail her.

If the vessel is wind rode, and on a lee shore, it will be prudent to claw out to sea for an offing. Set the storm canvas as if for a thrash to windward. Heave short, set the jib with the sheets slack, set the foresail, and if the vessel is to be cast on the port tack, haul in the port foresheet; put the helm to port; slack out a little mainsheet. As the vessel sheers to starboard break out the anchor or slip, and when she pays off enough so as to make sure of not flying to again, ease the fore sheet over, trim the main sheet and sail her. If the vessel does not gather way, but drives towards the shore, stand by to let go the anchor again: if one anchor has been slipped, the other should be ready on the bow. If there is not too much sea, the kedge with hawser bent to it should now be carried out in a boat; then as the anchor is hove short haul in on the hawser. When the anchor is off the ground haul the vessel ahead by the hawser, when the kedge is apeak, sheet the jib, and break out the kedge. When anchored on a lee shore a vessel should never wait till the wind and sea gets so bad that it is neither safe to remain, nor to attempt to leave.

To Tack a Cutter.—When the order is given "ready about," the fore deck hands will go to their stations at fore sheets and jib sheets, and one to the main sheet, seeing all are clear. The cry of "Helm's lee" will be the signal that the helm is being put down; ease up the jib sheet, and overhaul. If the vessel is coming round smartly, ease up the fore sheet or fore sheet purchase as well; the hand aft hauls in the main sheet. When the vessel has passed the point "head to wind," begin to haul in the jib sheet, and get the sail sheeted and belayed before the vessel is full again and gathers way; handle the fore sheet in the same way, and overhaul the main sheet. Care must always be taken not to pull the jib sheet over the forestay, and get a strain on it before the vessel has passed the "head to wind" point, or is filling on the opposite tack to the one upon which she has been sailing; otherwise a back sail will be formed, and the vessel will not fall off so quickly. On the other hand the jib, when the time comes for working the sheets, must be sheeted with all despatch; as, if the vessel is allowed to fill before the jib sheets are in, it will be hardly possible to get them in properly without a tackle if there be a nice breeze. So with the fore sheet.

In tacking a vessel in a sea, the fore sheet should as a rule not be let go until it is seen whether the vessel is going to fill on the other tack or not, as the sail may be wanted to pay her head off; when the vessel fills, the fore sheets must be handled with smartness. If there is much sea, a "smooth" should be watched for, to tack in. Never, if it can be avoided, attempt to tack with a big comber rolling in on the weather bow, as a "miss-stays" may be the consequence, to say nothing of the water that might be thrown on deck.

The helmsman will soon find out how the vessel likes the helm put down for quick staying; but generally the vessel should be kept a good full before giving lee helm. Then at first ease the helm down gradually, so as to shoot a good distance, and make as big a circle as possible. Then, as the vessel is near head to wind, put the helm right over to the rail, and keep it there till the vessel fills and gathers way on the other tack; keep the vessel a little off a good full till she is reaching along, and then bring her to wind "full and bye."

To Tack a Yawl.—The only way in which tacking a yawl is different from tacking a cutter is that there is the mizen stay to work. The stays lead forward from the mizen-mast head, and are set up by tackles; only the weather one is set up. In tacking the tackle is overhauled, and the lee stay set taut, and forms the weather one when the vessel has filled on the opposite tack. Generally a yawl does not stay so quickly as a cutter, and more frequently requires backing off by the foresail.

To Tack a Schooner.—Keep the vessel a good full. As the vessel begins to come to ease up the jib sheet, but do not let it "fly"; overhaul the fore-sheet purchase and fore-staysail purchase, and overhaul fore-topsail tack and sheet and clew up. As the vessel comes head to wind cast off standing part of foresheet and forestaysail sheet. As she passes the point "head to wind" haul in jib sheets and belay; haul in the standing part of the fore sheet and fore-staysail sheet and belay; then be smart with the purchases and get the foot of the foresail as straight as possible; fore-staysail sheet not quite so "straight," as there should be a little flow in the after leech, owing to the angle made by the luff of the sail, and if the foot be pulled "bar taut," the leech will generally be so too. Tack and sheet the foretopsail.

In hauling in the foresheet all hands should be outside it, and not between the sheet and the rail. Care should also be taken that the fall of the purchase is clear and ready to hand directly the standing part of the sheet is fast. One hand should be selected to stand by the foresheet cavel, and he should belay. Directly the order "belay!" is given all hands should haul on the fall of the purchase; the belaying hand taking care that a turn of the standing part of the sheet is caught round the cavel. It is highly important that the fore sheet of a schooner should be sheeted home; as, if the foot be slack, the sail, not being set on a boom, is certain to bag more or less. And when sailing close-hauled and the wind frees a trifle, the foresheet should always be the last one to be checked.

STERN WAY IN TACKING.—In square-rigged ships "stern way" is commonly the result of letting the head yards lie aback during tacking, but a fore-and-aft vessel, in tacking under ordinary conditions, should not be subject to stern way. However, sometimes, even in smooth water, if a vessel has been brought head to wind either too suddenly or too slowly, she may get stern-way, or be placed in the situation known as "in irons," when she will neither fall off on one tack nor the other, after being brought head to wind. If the vessel has stern way, it must be recollected that the action of the rudder is different from what it is with head way; that is to say, if during stern way the helm be put to starboard, the action of the water on the rudder will force the stern to port and the bow to starboard; and if the helm be put to port, the stern will be forced to starboard and the bow to port. Under the influence of head way just the opposite results are obtained.

But, in reality, the rudder has very reduced effect in turning a vessel one way or the other during stern way; and generally the helm can be left to take care of itself—always being mindful that it does not knock anyone overboard.

Let it be assumed that a vessel has been sailing on the port tack, and on the helm being put down that she failed to get farther than head to wind, or got in irons; the result would be that the wind would drive her astern—this would soon be discovered by looking at the water over the stern. The helm would be to starboard, and would have to be shifted to port, and the starboard fore sheet and jib sheet hauled in, and the main sheet slacked up. The stern would gradually drive to starboard, and the bow, under the influence of head sails aback, would go off to port. The head sails being aback would of course increase the stern way, and directly the vessel's head was well off the wind, and the vessel insured against coming to again, the head sheets should be eased up and hauled in to leeward. She would have to fall off till the wind was brought nearly abeam before she gathered headway.

Under the influence of stern way the pressure of water on the lee quarter can be made to help turn the vessel just the same as the pressure on the lee bow helps to press the bow towards the wind when a vessel moves ahead. Or suppose the vessel be head to wind, and has stern way on, and it is desired to cast her head to port, or fill her on the starboard tack; then if she be listed or heeled to port by all hands going on the port side or port quarter, the ardency of the pressure on the port quarter will press the stern to starboard, and necessarily the bow turns to port.

Thus, it will be frequently found, that the bow of a vessel, if she has sternway, and is heeled, will very rapidly fall off to leeward; even though the head sails are not aback, and the rudder, from the way it is turned, should prevent her doing so.

It should, therefore, be remembered, that when a vessel gets in irons, and is under the influence of stern way, that she should be, if possible, listed on the side it is sought to make the lee side. Easing the main boom off will allow the stern to come up against the wind more rapidly, and will help heel the vessel.

Missing Stays.—To get in irons or to get sternway on a vessel is not exactly missing stays, as to miss-stays means to come up head to wind and then to fall off on the same tack again—in fact, to fail in going about. Generally a vessel has a tendency to miss-stays through having too little after-canvas; that is to say, the centre of effort of the sails is too far ahead of the centre of lateral resistance. The fault may be cured by reducing the head sail; by increasing the after sail; by shifting the mast aft without reducing the sail; by rounding up the fore foot and heel; or by rounding up the heel.

But a vessel may generally stay well enough, and only fail in going about through meeting a sea on her weather bow as she is brought to wind; or through the wind following her round; or through the helm being put down too quickly or too slowly; or through the head sail being badly worked. Whatever the cause, directly it is seen that the vessel is going to fall off on the same tack again after coming to, lose no time; haul up the head sheets to windward, slack off the main sheet, and, if the vessel has stern way, bring the helm amidships. Directly she has fallen six or seven points off the wind, ease over the head sheets and trim them to leeward; and as she gathers headway haul in the main sheet, and sail the vessel a good full and try again. As the helm is put down, ease up the jib sheet smartly and haul in the main sheet, but let the fore sheet lie till the vessel falls off on the desired tack.

GYBING OR WEARING.—To gybe or wear is to keep the vessel off the wind by bringing the helm to windward until the wind comes astern and then on the opposite side to which it has been blowing. This manœuvre has sometimes to be resorted to when a vessel miss-stays. Set taut the weather-topping lift. Ease off the main sheet until the boom is well off the lee quarter, and if there be much wind or sea, trice up the main tack and lower the peak; if a topsail is set it should be clewed up. Have as many hands as can be spared at the main sheet. Put the helm up. As the vessel's head goes off and brings the wind nearly astern, rally in the main sheet, and be careful that there is a smart hand stationed to take a turn with it. As the vessel comes stern on to wind, overhaul what has been the weather runner, catch a turn with the main sheet; and, as the boom goes over, meet her with the helm, so that she does not fly to, head to wind. Ease up the topping lift, and trim tacks and sheets.

If the vessel be already before the wind with the main boom square off, when it is necessary to gybe her, take the same precautions, if there be much wind, by tricing up the main tack, lowering peak, and clewing up topsail, not forgetting to set the weather topping lift well taut, if it is not already taut, as it certainly should be. Luff a little, and get in some of the main sheet; when the boom is on the quarter (at about an angle of 45° with the keel), steady the helm and put up gradually, still getting in the main sheet. Hook on the lee runner and set taut. Then, as the wind is brought astern, overhaul the weather runner, belay the main sheet, let the boom go over, and meet the vessel with the helm. Overhaul the lee-topping lift, and trim tacks and sheets.

These are the ordinary precautions taken in gybing whilst cruising; but in match sailing, unless something like a gale of wind be blowing, the main tack is not triced up, nor is the peak lowered. There will, however, be the topmast preventer backstay to attend to. Station one man at the weather preventer to overhaul and unhook the tackle as the boom comes amidships. One hand to the fall of the whip of the lee preventer, who must haul the backstay aft as fast as the main boom is brought aboard; he must get the whip as taut as he can, and belay before the boom is gybed. The tackle must be then hooked on the preventer to set it up. In large vessels two hands should be told off to the lee preventer.

In a schooner similar precautions will be taken, and there will be the foretopmast preventer backstays to attend to, and the fore-topsail should be clewed up. The fore sheet can be left until after the main boom is over.

Club Hauling.—Club hauling may have to be resorted to in a narrow channel sometimes when there is neither room to stay nor wear. Get an anchor on the lee bow with a warp bent to it; lead the latter to the lee quarter. Have the cable ranged on deck unshackled; put the helm down, and keep shooting with the sails shivering. When way is stopped, let go the anchor; as she is brought head to wind let all the cable run out through the hawse pipe, and haul in on the spring. The anchor, of course, will be got in over the stern.

Another better plan for a small vessel is to bend a warp to the kedge, and as the helm is put down drop the kedge over the stern, then hold on and haul in on the warp.

To Heave To.—Haul the fore sheet up to windward, and the jib sheet until the clew just clears the forestay; ease the main sheet a little until the vessel lies quiet with her helm amidships. If there is much sea, the vessel is sure to fall off and come to. She will generally fall off as the crest of a wave comes in on the weather bow, and come to as the bow is in the hollow of a wave, or as the crest of a wave lifts the stern. Some vessels are much more troublesome in this way than others, and some will come to with much more way on than others. The principal danger is that, if much way be gathered in coming to, she should also meet with a big comber on the weather bow; to avoid this danger the man at the helm should meet the vessel as she runs off, and bring her to with the helm, always being careful not to get her head to wind. At the same time a vessel must be allowed to fall off freely with the sea, to the extent perhaps of three or four points, or until the wind was nearly abeam; but in bringing her to, her head should never be allowed to come within a couple of points of the wind.

To Heave To after Running before a Heavy Sea.—Give warning below that the vessel is about to be brought by the wind, and see that everything is well secured about the deck. Watch for a "smooth" (which is brought about by several large waves meeting, and being broken up and dispersed into several small ones). Put the helm down, rally in the main-sheet smartly; meet the vessel with the helm before she gets head to wind. Trim the head sheets as necessary. If the vessel has been running with a great deal of canvas set, it must be reduced as the vessel is brought to the wind; and the peak should be lowered as the vessel comes to.

Squalls.—If a squall is long foreseen, the sailing master will of course have snugged down and got his vessel so as to meet it end on if possible; but if caught unawares lose no time in letting jib sheets fly, and haul down the foresail. Set the topping-lifts taut; let the peak drop down between the topping-lifts until the gaff is about square to or at right angles to the mast. Then haul up the main tack and the mainsail will be scandalised. If the sail be a laced one let the throat come down instead of the peak, keeping the peak downhaul fast to the centre of the boom to leeward to prevent the sail blowing out. If the vessel has the wind abaft the beam when she is actually struck, put the helm up a little to keep her before the squall. If the squall strikes her before the beam, put the helm down. If the vessel gets struck or knocked down on her side before the sails can be lowered cast off the jib sheets, pull the foresail down by the downhaul. Haul the main boom well aboard, cast off the throat halyards and the throat will fly down, then cast off the peak halyards and haul in on the peak downhaul. If the vessel does not right get the kedge up if a bottom can be reached, bend the hawser to it and let go over the stern; then the vessel may wear round so that the wind will take her on the other side. If the ballast or anything else shifts to leeward, trim it back to windward. Close up the companion hatchways and skylights, to keep the water out.

To Scandalise a Mainsail.—Set taut the topping lifts. Trice up the tack, and lower down the peak between the lifts.

Sailing by the Wind.—Sailing a vessel successfully on a wind is quite an art, and no amount of tuition will make a man a good helmsman if he be not "to the manner born." However, there are very few men who do not think that they can steer a boat on a wind better than any other man, just as every man fully believes that he could drive a four-in-hand, edit a newspaper, or checkmate a Russian diplomatist. Still the fact remains, that some men cannot sail a vessel on a wind, and no amount of instruction will teach them to know for themselves when a vessel's sails are full or when they are "near." Some vessels are so beautifully balanced—that is, their centre of effort and centre of lateral resistance are nearly in the same vertical—that in moderate breezes they will "sail themselves" on a wind and only require a little weather helm now and again as the wind heads them. Yet a bad helmsman will find more difficulty or do worse in steering one of these vessels than he would in steering a very hard-mouthed vessel—one that carries a lot of weather helm, for we never supposed a vessel carries lee helm. The well-balanced vessel is what may be called sensitive to her helm, or "tender mouthed," and the least touch of her helm will bring her to, and the gentlest pull on the weather tiller lines will take her off; such a vessel steered by a man with a "coarse hand" will be always "off" or "near," and never really "full and bye;" one minute he will slam the helm down to bring her to the wind, and the next haul it savagely to windward to keep her off the wind; whereas, if the vessel had been left alone with a free tiller, or with only the very slightest strain on the weather tiller lines, she would keep herself full and at the same time eat to windward as she luffed to every free puff. A vessel that carries a lot of weather helm does not require such delicate handling, and a man may tear away at the weather tiller lines until he is black in the face and he cannot do much harm; he will be delighted to find he has got hold of something to "hold on by," and all the strength in his arms will no more than keep the vessel out of the wind. But, although a good helmsman cannot be made out of a naturally bad one, it does not follow that a few hints would not be of service to the inexperienced who may have the light hand, quick eye, and sensitive skin of a perfect timoneer.

In the first place the sails should be as nicely balanced as possible, so that in a topsail breeze, when the channels are barely awash, the weather tiller lines only require to be kept just taut, with the rudder turned no more than six or seven degrees off the keel line. We are, of course, assuming that the sail plan has been so judiciously arranged that the effort of the sails when effectively trimmed, will be balanced by the lateral pressure on the hull. If the sails are so well balanced then the weather helm will about equal five or six degrees in a moderate breeze, and it should not much exceed this nor be much less; if it is much in excess the vessel will be what is called ardent, and her constant effort to fly to will necessitate the helm being kept "right across her keel," which will very much interfere with her speed. On the other hand, if much less than six degrees of weather helm is carried in such a breeze the vessel will be what is called "slack," and will require constant doses of lee helm, and the result will be that the vessel will crab to leeward, and in tacking will be so slow in coming to that she will probably lose all her way before she gets head to wind, and then will require helping round by the foresail.

If the vessel in a nice breeze does not seem to gripe as she ought—that is, does not make much effort to fly to, and so cause a good strain on the weather tiller lines to keep her off the wind—first see what the effect of drawing in the main sheet a trifle will do; if this only improves matters a trifle, and the boat seems dead in the water or does not pass through it with any life, go forward and have a look at the jib sheets and foresheet. See that the jib sheets are not pinned in, and that they are rove through the right holes. If the first jib be set and the sheets rove through the second jib-holes, the foot will be in a curve and the sail more or less in a bag; the effect will be to drag the vessel's head off the wind and not assist in driving her ahead an inch. If the sheets be rightly rove, but hauled in too flat the foot of the jib will be straight enough, and the sail generally be flat enough; but the effect will be that the sail, being trimmed too close to the wind, will, as in the other case, press the vessel's head off the wind, and be of little service towards driving her ahead. It requires some experience of jibs and the way of trimming their sheets to know when they are trimmed so as to be most effective, and it would be difficult to frame advice on the point; but the leech should be straight, the foot nearly straight, and the luff should not lift—*i.e.*, shake. If the luff lifts it will be a sign, as a rule, that the sail is not sheeted flat enough. On the other hand, the clew should be well off the lee rail, and the sheet and the foot should make an angle, or rather a gentle curve from bowsprit end to sheet hole; if the sheet and the foot, when the sails are full, make a "straight line," it will be a pretty sure sign that the sheet is too flat.

If the vessel carries an excessive amount of weather helm, more than previous experience of her sailing would lead one to expect, and does not pass through the water freely, it may be relieved by easing off the mainsheet a trifle and flattening-in the jib sheets, but the mainsheet must not be so much eased as to cause the sail to lift, nor must the jib sheet be flattened-in so as to make the jib simply a pressing sail. In vessels that are broad at the bow the jib sheets can be much better trimmed, as there is less chance of getting the sheets too flat; hence, as a rule, second jibs are always made to stand better than first jibs. [In very narrow vessels, outriggers are frequently used to lead the sheets through and get more spread.]

Now we will suppose that the sails are all nicely trimmed, doing their work properly, and that the vessel carries just the right amount of weather helm, and will fly to directly the weather tiller-lines are released. In the first place, we will say a few words as to the position of the helmsman. As a rule, the steersman stands near to or sits on the weather rail, and this is undoubtedly the best position; he can then look into the jib and foresail, see when they are inclined to lift, and at the same time watch the luff of the mainsail and the vane or flag, which, if there be a topsail set, should flicker just on the weather side of the yard. But sometimes in light winds a man may sit on the lee rail and watch the head sails from under the lee of the mainsail, and this will be occasionally a capital position if a jib topsail be set. The weather tiller-line must, of course, be rove through the sheave in the weather rail, then, with the fall in his hand to leeward, the helmsman can keep his vessel off or bring her to at will. Of course, we do not mean that a man might always equally well sit down to leeward and steer, but there is no better place for seeing the sit of the sails, and an occasional visit to leeward will often prevent the necessity for shouting out "How are our head sheets?" which invariably produces a general scramble of the crew to the lee bow, and a chorus "All right, sir!" Some men we have seen get a deck cushion and sit down by the side of the tiller and hug it as if they had got hold of the neck of a favourite donkey. They may be very good helmsmen, but their hunched-up appearance, as they squat on their haunches cuddling the tiller, necessarily makes one form a very poor opinion, at least, of their "style," and frequently the man can be put down as more or less of a sloven.

It can be concluded that the best position for the helmsman when sailing on a wind is as near the weather rail as possible; he can then really see for himself what the head sails are doing, and the admonition "She's near for'ard" need never be heard.

The jib is perhaps the best guide for the young helmsman, and if he steers by that alone, ought always to be able to keep his vessel full and not allow her to get off the wind. With a nice topsail breeze—not strong enough to lay the vessel in to the deck—the luff of the jib will be just rippled, or the canvas into which the luff rope is stitched will more or less "bag," and will be in a constant state of quivering (see p. 23); but the luff of the sail must not be allowed to lift, *i.e.*, to go into large folds, as, if it does, it will be a sign that the vessel is too near. If you are keeping the vessel a good full there will be no ripples or wrinkles in the luff of the jib—unless the jib be a very old and badly-stretched one—and all the sails will be quiet.

In sailing by the luff of the mainsail, as some men do who cuddle the tiller, the young helmsman may be apt to get his vessel off the wind, as he will be constantly thinking she is "near," through the eddy wind out of the foresail making the luff of the mainsail shake. The luff of the mainsail is thus a not very trustworthy guide for the inexperienced, still, as a rule, when the luff of the sail lifts and begins to travel aft across the belly of the sail in waves, it will be a pretty sure sign that the vessel is "starved of wind," and a little weather helm should be given her.

Sailing by the vane, burgee, or racing flag, is said to be the easiest and at the same time the most trustworthy guide for close-hauled sailing; but a very little experience will soon prove the fallacy of this. If the vessel is moving along at a good pace, say five or six knots an hour, the flag will blow aft nearly in a line with the keel (see page 21), and if there be a square-headed topsail set, the flag will flicker on the weather side of the yard. But in such light winds as we are now assuming to blow, there may be quite a different current of wind aloft. Thus we frequently hear the remark "She's near for'ard" responded to by the helmsman, "She's all full aloft, look at the flag,"—and probably the flag will be right across the vessel. Or the flag may blow out to windward of the topsail yard, or droop and cause the helmsman to think that he has got his vessel head to wind, and he will of course haul the tiller to windward. This, perhaps, will cause a shout of "Bring her to!" or "Let her luff, she's all off the wind," and an appeal to the vane or racing flag will only show what a misleading guide it is. In fact, trying to sail the vessel by a vane, or by the luff of a topsail, will be certain to cause "remarks" to be made forward, and as these remarks have always an irritating effect on the steersman, he had better sail on a wind by the head sails than by the flag, especially so as he will thereby be able to keep the lower sails doing their work, and it is the lower sails which must be most depended upon for getting through the water.

An old hand will sit down by the tiller and, perhaps, close his eyes, and still fairly sail a vessel on a wind, as long practice will tell him how she heads by the feeling of the wind on his face. He will not deign to look at jib, mainsail, or flag, but will give the vessel lee or weather helm just as he feels the wind on his face come freer or shorter. This really is a very good guide, and the steersman when he gets thoroughly acquainted with the sailing of a vessel on a wind, will find a "chill" on his face a very trustworthy hint as to the doing of a paltry, shy, or baffling wind.

In sailing on a wind, keep an eye on the head sails, after sail, upper sail, and vane, and the other eye to windward, for nine times out of ten the direction of an impending puff can be seen as it travels towards the weather bow of the vessel, rippling the water in its course. If the dark ripples are seen coming broad on the bow, you will know that it will be a good luffing puff, and as it takes hold of the vessel, ease the weather tiller-lines, and let her luff to it freely, but do not allow the jib to lift; then, if the puff is a mere "chill," out of a passing cloud, perhaps, and leaves the wind as before, do not wait till the puff has passed over before the helm is hauled a-weather again, or the vessel will be left nearly head to wind, and this would be a very lubberly proceeding; therefore, before the "free puff" has blown itself out, put up the helm and get the vessel full and bye again.

If you see that the puff is a strong one, of the nature of a squall, do not get nervous and luff before it strikes the vessel, unless of course it is considered prudent to shoot up head to wind to meet it. If you begin luffing and lifting the sails before the squall strikes you will deaden the way of the vessel, and then the squall will have much greater effect in heeling the vessel, and will perhaps take the topmast away—as a very frequent cause of topmasts being broken is by being caught in a puff when the vessel has no way, or but little way, on.

But puffs as frequently come ahead as broad on the bow, and the head puffs are the more difficult to deal with. Keep a good look-out for these "nose-enders," and if lucky enough to see one before it reaches the jib, keep the vessel off a little, and, if possible, prevent the sails lifting at all. These puffs will be most frequently met with when sailing along under high land or under trees; one minute a puff will come broad on the bow or on the beam and lay the vessel in to the skylights, and the next one will come right ahead and bring her upright as a monolith; and what with luffing to one puff and keeping away for another, the helmsman will have his vigilance very highly tested. He, of course, will not be able to keep the sails from lifting at all, as the puffs are more or less revolving, and Palinurus himself could not successfully dodge them; still, with care, a vessel should never be allowed to get head to wind so as to want backing off by hauling the foresheet to windward and easing off the mainboom—this would not be seamanlike, and would betoken great inattention.

In luffing to free puffs, or in keeping away for foul ones, do not "slam" the helm about; that is, do not shove it down as if you were trying to avoid striking something, or haul it up as if you were bearing away round a mark. Generally easing the tiller lines will enable the vessel to luff all that is necessary, and when free puffs are about a very light hand should be kept on the tiller lines, and the vessel will dance herself to windward and eat out on the weather of one whose tiller has been held in an iron grip during all the puffs. Get all the luffing possible out of a vessel, and never miss the smallest chance of a gripe to windward, even to a quarter of a point of the compass; but do not put the helm down so coarsely that there is a danger of bringing the vessel nearly head to wind; if this is done the helm will have to be put hard up to get her off the wind again, and nothing so interferes with good performance on a wind as too much ruddering. A good helmsman must have a light hand and unceasing vigilance, as "weatherly qualities" are in no small manner dependent on the way a vessel is steered. Therefore it cannot be too frequently repeated that the faintest semblance of a luffing puff must never be disregarded, and the vessel must at the same time be humoured so tenderly to it, that no one shall see what the helmsman is about unless by watching his movements very closely. On the other hand in using weather helm in keeping off to avoid a foul puff, it will not do to be too slow with the helm, or the vessel will be stopped, and, without way on, it will be some trouble to get her full and going again. Therefore always put the helm up as promptly as possible, but do not haul it savagely on to the weather rail as if you were going to sail "large" for the rest of the day. If a puff is not seen coming broad on to the bow look out for one coming ahead, and directly the jib shows the slightest sign of lifting, drag steadily on the weather tiller lines; if the puff is a very bad one, the helm must be smartly hauled aweather, but as a rule the foul puffs will not vary in direction more than a couple of points from the direction of the true wind, and they must be accorded with by as delicate a use of the helm as for "luffing puffs."

Thus the secret of close-hauled sailing consists in such a constant watching of the wind and such a use of the helm to meet its variations, that the vessel is always "full and bye," and never "near" or "off" the wind. When a man can so sail a vessel, he will be a perfect helmsman, and will make her eat to windward as fast as the very best professional skipper could.

Speaking of professional skippers reminds us that many of these have a funny habit of "sawing" the helm backwards and forwards; that is, they haul on the weather tiller lines and then ease them without apparent motive, generally accompanying the performance with a corresponding see-sawing motion of the body, by first resting on one foot and then on the other. Probably this peculiar habit was acquired on board fishing vessels in the winter, when the men might find sawing the helm and working their bodies about promote warmth. It certainly is no assistance to a vessel, and is very "bad form."

Sailing a vessel in a strong wind, say with the scuppers full of water, will not be quite such a delicate operation; still, the wind will vary a great deal, and the very most must be made of the free puffs, and the effect of foul ones reduced as much as possible. The vessel will of course carry a great deal more weather helm, and when the sails are nicely trimmed the jib will be found the most reliable sail to steer by, as the luff of the mainsail will lift a great deal from the mere effect of the wind out of the foresail. Look out for the very hard puffs, and do not allow the vessel to needlessly bury herself; on the other hand, do not get frightened at a little water on deck, and throw the vessel in the wind. Sail her along heartily, even to the rail under, but never forget to ease the tiller lines for the smallest freeing of the wind; and for the very heavy puffs do not luff before they strike, but luff into them as they strike; the vessel will then not be knocked down so badly,and will walk off with increased speed by the aid of the puff.

It must not be supposed that it is a good thing for a vessel to be sailed with her rail under and the water nearly up to her skylights; but in sailing on a wind she should not be luffed up for the mere sake of getting her out of such a condition if it is only a passing puff that has laid her in; luffing, as a rule, in close-hauled sailing, is to take advantage of free puffs; but occasionally when the puff is very strong, and neither free nor foul, advantage may be taken of its strength to do a little luffing, and the same time clear the lee deck of water; in such luffing the chief care of the helmsman will be not to get the vessel so near the wind as to much stop her way or risk getting in irons.

Frequently in match sailing a vessel is found to be heading for her mark, and the hope of the helmsman will very properly be that she will fetch without making a tack; but he must not get anxious about it, and hug the wind; if he does the vessel's way will be deadened, she will make an unusual amount of leeway, and it will be a hundred to one against her fetching. He must sail her along boldly, not courting another tack, but exercising all his care in keeping her an exact full, and she will probably fetch; never mind if her head now and again falls to leeward of the mark, it will probably come to windward of it again; but on no account get nervous and try to *steer* for the mark. If such an attempt is made, the mark will not be fetched, and the attempt will be quite contrary to the principle of the art of close-hauled sailing, which art cannot be regulated by steering for fixed marks. There is an old saying that "keep a vessel full and she will eat herself to windward, but by trying to sail her in the wind's eye she will crab to leeward." Occasionally a little "niggling," as it is called, may be indulged in if the mark is very near; but even then the vessel must not be sailed so fine as to cause the head sails to actually lift; and when within fifty yards or so of the mark she should be ramped along a good full and shot up to windward of the mark with good way on, as if she be gilled up to the mark with little way on, and got met at the last moment by an unfriendly puff, a collision with the mark would be almost a matter of certainty. This, although a most humiliating spectacle, very often happens, as skippers will do almost anything to save a tack; but it is only the smartest of them that can judge when a tack can be profitably saved and when not.

Sailing a Vessel on a Wind in a Heavy Sea.—It will require some nerve to sail a vessel successfully on a wind in a heavy sea. Often a haunting fear that the bowsprit will be carried away or the deck swept by a green sea, makes a man have the vessel's sails constantly lifting; the result is that she tumbles about in the sea like a log, sags to leeward, and gets the character of being a bad sea boat. Do not fear the breaking of a bowsprit or a green sea on deck; be not unmindful of either, but above all things keep the vessel ramping full; this is the secret of success in sailing on a wind in a sea. Of course it is assumed that the vessel is properly canvassed: if she has two reefs down in the mainsail, that the foresail is single reefed, third jib set, bowsprit reefed, topmast lowered, and everything securely lashed on deck. The vessel should be canvassed so that in the true strength of wind the covering board would be well out of water—a fourth of the height of freeboard.

In a sea it will not do to sail a vessel rail under, as a weight of water on deck and the fact of the vessel being over on her side will greatly interfere with her good performance; therefore a vessel should be canvassed so that her rail will not go under, and in the squalls she must be eased judiciously with the helm, always remembering that although occasional easing may be prudent the chief aim must be to keep her full. The main boom should be eased off a couple of feet or so farther than it is in smooth water, and the weather topping lift should always carry the weight of the boom. The head sheets should also be eased, but not so much as to cause the jib to lift badly, as the jib will be wanted to keep the vessel out of the wind.

As a rule the vessel will be found to pitch pretty regularly, and one sea being very much like another, the vessel will be sailed through all, hard and a good full. Do not let her sails shake, as her way will be stopped; she will then pound the sea and jump two or three times into the same hole. Those on board will say "what a horrid bad sea boat she is, that she pitched two or three times to the once of any other vessel, and always had her deck full of water." But keep a wary look-out for the big seas. One will be seen rolling in on the weather bow gradually gaining in height, and perhaps rising, pinnacle like, just at the point where the vessel will meet it. This is the wave to be ready to meet; it will rise higher and higher as it gets towards you, and will either curl over and break up by its own exhaustion, or from the fact of its meeting the vessel, and there will be in either case a ton or two of water on deck. Just before the big wave reaches the vessel there will be an unusual hollow or deep trough, and into this she will and must go; before she can recover herself the big wave will roll over and fairly swallow her up; then there will be a smooth; a number of small waves will be formed; the vessel will give one or two deep dives—the result of her bow being thrown up by the big wave—and then be steady for a minute or so in the smooth.

When a big sea like this is seen on the weather bow, the vessel should be eased a little just before it reaches her so that she may take it more fairly stem on; but in luffing into the wave do it in good time, and directly she is fairly into it put up the helm again, and fill her sails before she has time to get head to wind. The object in easing the vessel is of course to ease the shock both by deadening her way and by presenting the stem to the sea instead of the bluff of the bow; therefore directly the sea and the vessel have met, the effect is over, and the vessel must be filled instantly; that is, she must be put off the wind again to a good full and bye.

The most tiresome of all seas to sail a vessel in are those which are met with in more or less shallow water, such as on the Brambles, at the mouth of Southampton Water, or on the Bar at the entrance to the Mersey. Here the sea is furrow-like; that is, the troughs are long and deep, and the crest of the waves are a succession of sharp ridges instead of the long-backed waves met with in deep water. So long as a vessel keeps time with these waves, that is, so long as she only pitches once into each hollow, there will be a regular succession of pitching and scending; but if, through the wind heading her, or through careless steering, her way becomes deadened, and she pitches twice into the same hollow, or if she does so through meeting a trough of unusual length, there will be trouble on deck in the way of water, as the vessel will meet the wave crest just as she takes her second dive instead of when she scends from her first. There will be two or three very quick dives after this, and the helmsman must keep the vessel full; not shake her up because she is taking these unpleasant plunges, but keep her full in order to keep her going through the sea, and to get her into the regular fall and rise of the waves again, or, as the sailors say, make her toe and heel to the same tune.

It can be supposed that the vessel is sailing in a pretty regular sea, and that she rises, and at the same time cleaves through a wave as at A.

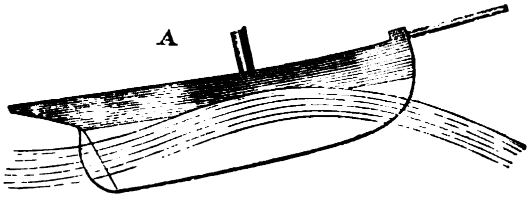

FIG. 81.

Whilst she is going up through the wave, or scending, she will show a tendency to come up to the wind, as her stern will be so little pressed by the water that it will go off to leeward. She will stop in suspense for a moment and then pass rapidly through the wave, and the next moment will be in the position B, when her bow, being unsupported, it will fly off

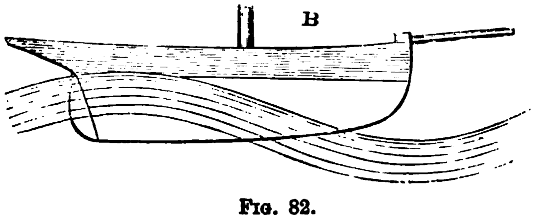

FIG. 82.

the wind. This latter tendency must be guarded against, as in another moment the vessel will be in the position C, with water well nigh up to the bowsprit bitts. She will rise streaming with water at *d*, and take the position A again, and so on *ad nauseam*. Very frequently a vessel will shoot so far through a wave when in the position A, that she even gets farther through it than shown by B; this is what a vessel does that is sailed fast through a sea with a lot of canvas and with a tremendous momentum, due to the speed and weight of the vessel and her manner. Often three bigger waves than usual will come one after the other and then there will be a smooth, but frequently the three are thought to follow, when in reality the vessel is only plunging from the effects of the motion imparted to her by one big wave. At any rate when the vessel gets into the position of B, she should be put as fairly into the sea ahead of her as possible. If there is no big sea ahead she will fall harmlessly enough into the trough and will hardly require easing.

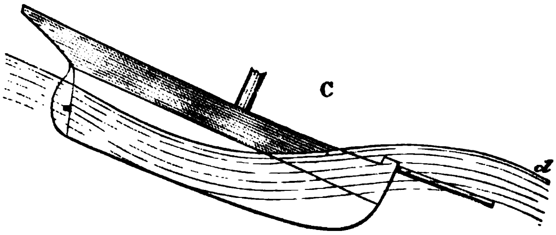

Fig. 83.

In sailing a vessel hard through a sea like this, the motion will necessarily be unpleasant, as, instead of rising leisurely as it were to the waves, and pitching gently, the vessel will more or less of her own momentum throw herself ahead; this will not only make the motion quick and unpleasant, but will put a great strain on the gear, but as it is more a question of getting through the sea than riding over it with comfort and with safety to the gear, the last words on this subject will be, keep a firm hold of the weather tiller lines.

Sailing off the Wind.—Sailing off the wind means that the vessel is more away from the wind than the close-hauled point, and applies up to the time when the wind blows four points abaft the beam; then the vessel would be said to be before the wind, and the wind would be quarterly. In sailing with the wind abeam, the head sheets must not be eased up too much, but a good strain must be kept on them, as the vessel is almost certain to gripe a great deal, and to show a tendency to fly to; of course, if the head sheets are eased up so that the sails are always lifting, this tendency will be much more urgent.

Neither must the mainsheet be eased off too far; if it is, the weather cloths of the sail will "lift" and go into folds. If the fore part of the sail does so lift, the mainsheet must be drawn in a little until the sail has the full weight of the wind and falls "asleep." Frequently the luff of the sail may be quiet enough; but the topsail may lift, and that will be a sign that the mainboom wants hauling aboard a little, so as to get the peak more inboard, and thus make the topsail stand better But the mainsail must not be pinned for the mere object of making the topsail stand; if the luff of the latter be to windward of the topmast, the cause of its lifting may be the eddy wind round the mast.

With the wind abeam the vessel will be laying her course, and the helmsman will have to steer by compass or by keeping some object straight on for the bowsprit end. Every tendency the vessel shows to fly up in the wind must be promptly met by the helm; do not hold the helm as if the object was to keep it rigidly in one position, nor wait until the vessel's head has ranged up two or three points. Watch the compass card or the object you are steering for, and directly the vessel brings her head to windward give her a little weather helm and keep her straight if you can. If she shows a tendency to fall off, meet her promptly with a little lee helm, and always remember that the object is to make her keep a straight course, and to prevent her yawing either on or off the wind. It will not be a question of keeping the sails full and no more than full, but that of making the vessel go straight as an arrow for her object, always recollecting that if she yaws about that of itself will stop her way, and there will be also the action of the rudder to bring her back on her course; therefore using a little helm promptly will prevent yawing, and the checking of the vessel's way from this cause will be reduced to a minimum.

But a vessel may gripe through the wind shifting more aft, or she may show a tendency to run off through the wind coming more ahead, therefore the vane must be watched and the blowing of the wind on the face should also be regarded. In match sailing especially, slight alterations in the wind should be observed, and we have frequently seen the mainsheet laid along the weather side of the deck in the hands of the crew, who slacked off or drew in the boom to suit every slight alteration in the wind. Of course this would only be done in very light winds, but all cases and alterations in the wind that make a palpable difference on the amount of weather helm carried, should be promptly provided for by trimming the sheets.

In sailing along the wind in a sea—it would not be attempted if the sea were very heavy—the helmsman will find some difficulty in keeping his vessel from griping-to or running-off, as the sea will carry her about a great deal. He should be well prepared to give her lee helm promptly if she shows a sign of running-off, and should either keep the lee tiller line in his hand, or the tiller itself, or should have someone to leeward of the tiller, the latter if the vessel be a big one, say of 70-tons, or upwards. If the vessel gripes-to, she must be given weather helm; but checking the tendency to "run off her helm" will require the most care, and lee helm should be given a vessel directly her head begins to fall off when sailing along the wind. With a heavy beam sea a sensation will be experienced of slipping down the side of the waves; but, as before said, if the sea is very heavy, she should be either put head to it or before it.

With a beam wind if there is much strength in it—so strong that a topsail lays her into the deck edge—the vessel in the puffs will now and again shove her rail under, but she should never be permanently sailed with more than two or three planks of the deck awash. Sail should be shortened without hesitation if the reach is a long one, and if the wind seems bent on a good steady blow. But if it is a mere puff, or if the reach be a short one of a half mile or so, the vessel must be eased to get the water off deck, and ramped along again in the lulls. Some judgment must be exercised in so easing a vessel, as if her sails are made to lift very much her way will be stopped; on the other hand, if she has to sail with her lee deck full of water up to the rail, that will stop her way, and so the aim must be to stop her speed as little as possible from either cause, and as before said, if the reach be long and the wind a lasting one shorten sail.

To Run before the Wind in a Heavy Sea.—Have the boom topped up, so that the boom end will clear the combers if possible during the lee roll. Bend the boom-guy by making fast with a clove-hitch the thimble end to the boom, about two-thirds of the length of the boom from the mast. Take the guy forward, pass the bight round a cleat, and bring the end back, and reeve through the thimble, and belay. Sometimes the guy is simply taken forward and belayed, or set up by a tackle. If the sea is very heavy the mainsail should be stowed and trysail set. The squaresail reefed should be always set under such circumstances, but it is best to have the trysail as well, because if an accident happened to the squaresail, the vessel can be brought to wind and hove to under the trysail. The foresail would be lowered, but a jib should be always kept set.

Another reason for preferring a trysail to a close-reefed mainsail is that the head of the sail is higher, and will keep the wind whilst in the trough of the sea, whereas a close-reefed mainsail might be becalmed. For the same reason, to avoid being becalmed, a reefed square sail should always be hauled close up to the hounds.

In running before a wind and sea great care must be taken that the vessel does not get by the lee; that is, that she does not run off so much as to bring the wind on the other quarter and gybe. The lazy guy would most likely prevent the boom coming over; if it did not look out, and keep clear of the main sheet if you are near the counter, and then lie down on deck; as if the boom is brought up suddenly by the runner, it may break and sweep the deck.

Supposing no accident occurs, "meet" the vessel promptly with the helm, and do not let her fly to; then prepare to gybe the vessel back again; get in some of the main sheet; drop the peak down; put the helm up and gybe her handsomely.

If when running under squaresail the vessel broaches to, that is, flies up into the wind and gets aback, brace the squaresail sharp up, and haul the weather jib sheet taut with the helm hard up until the vessel is before the wind again. If the vessel flies-to quite head to wind, the squaresail must be stowed and the foresail set, if necessary, to back her head off.

It is generally supposed that a large quantity of sail must be carried when running before a heavy sea, in order to keep ahead of the waves; or, in other words, to avoid being pooped. This is not exactly the case, as the speed of large waves is much too great for any vessel to run away from them; thus an Atlantic wave 200ft. in length (such as would be met with in a brisk gale) travels at the rate of twenty miles an hour, and no vessel could run at that speed. The height of such a wave might be about 35ft., but probably would be not more than 15ft. and the object of having much canvas set would be that a vessel might not get becalmed in the trough of the sea, and by suddenly losing her way cause an overtaking wave to be broken up; a quantity of water might then possibly fall on board. [It must always be understood that it is not the water which travels, but only the wave motion]. This would be termed "pooping," and to avoid such accidents square topsails have been much recommended for large cruising yachts, as, owing to their loftiness, they are unlikely to get becalmed in the trough of the sea. However, pooping more frequently happens from quite a different cause: as a wave advances it will sometimes grow in height and lose in length, and as a wave form cannot be sustained after a certain proportion of height to length has been reached, the crest of the wave becomes suddenly sharp and still higher, and ultimately curls over on the side it has been advancing. If this breaking up of a wave—which under such circumstances might rise to a height of 50ft.—should happen close to the stern of a vessel, she will be inevitably pooped; that is to say, some of the water will fall on board, and the crew will have to hang on for their lives.

Large deep sea waves, when they approach shallowness, alter in form and lose their speed; they become shorter and higher (deep-sea waves whose original height was 40ft. have been said to rise to 150ft. as they approach the coast), and then the crests, travelling faster than the troughs, topple over in broken masses. Hence waves in shallows or near the coast are more dangerous than deep-water waves.

TO ANCHOR WHEN ON A WIND WITH WEATHER-GOING TIDE.—Get the anchor ready on the bow, and some cable ranged on deck. Have the jib and foresail ready for lowering. When abreast to leeward of the spot where the anchor is to be let go, take in jib and foresail, put down the helm; when head to wind bring the helm amidship, and shoot to the spot where the anchor is to be let go.

ANCHORING IN AN OPEN ROADSTEAD.—In coasting it may be frequently convenient to bring up for the night under the land, but if the weather looks at all bad seaward, the precaution should be taken to unshackle the cable and bend the watch buoy on. Then if the sea did get up in a great hurry the cable could be slipped, and recovered on another occasion.

TO ANCHOR WHEN ON A WIND WITH LEE-GOING TIDE.—Take the same precautions as before, but a little wider sweep to allow for the tide that is running to leeward.

TO ANCHOR WHEN RUNNING BEFORE THE WIND, BUT AGAINST THE TIDE. —Stow the mainsail, take in the jib, put the helm down, shoot head to wind, lower the foresail, and let go the anchor.

Or stow all the sails, and do not alter helm. When the tide has brought the vessel to a standstill, let go the anchor.

TO ANCHOR WHEN RUNNING BEFORE THE WIND AND WITH THE TIDE.—Take in jib and foresail, haul in the main sheet, put down the helm, and when head to wind keep shooting till way is stopped; let go the anchor, and stow the mainsail.

If moorings have to be picked up, the same course will be followed; but judgment must be exercised, so that when the vessel shoots up to the watch buoy her way is almost or quite stopped.

TO MOOR.—Veer out chain about double the length of cable it is intended to ride by; when the vessel has dropped astern and brought the cable taut, let go the second anchor; veer out chain, and heave in on the anchor first let go until an equal length of chain is out. If the yacht will not drive to a spot suitable for the second anchor, send out a kedge and warp in the boat; warp the yacht to the kedge, and let go the anchor. Or the second anchor and chain can be carried out in the required position in a boat. In such case, only as much chain as it is intended to ride by need be veered out to the first anchor.

The quantity of chain to ride by will greatly depend upon the nature of the bottom, the strength of the tide and wind. Generally about three times the depth of water at the top of flood.

To UNMOOR.—Heave in on one anchor, and pay out chain on the other. Break the first anchor out of the ground, cat, and then get the other. In some cases the second anchor might be got by the boat under-running the chain.

CARRYING AWAY A BOWSPRIT.—Directly the bowsprit is gone, ease the main sheet and haul the fore sheet a-weather; but if the vessel has been reaching well off the wind, she must be brought to wind and in either case hove to. If the bowsprit is carried away near the stem, in consequence of a shroud bursting, the outer end will fly aft. Lower the jib and unhook from the traveller. Put the bight of a rope under each end of the bowsprit, the end of the inner part of each rope being fast on the deck; haul on the other part, and thus roll or parbuckle (see Fig. 84) the bowsprit up the side of the vessel to the deck. Then clear the gear. The bowsprit may be got out again with sheepshanks in the shrouds. If the end of the bowsprit breaks off outside the jib-tack sheave hole, let the jib fly by easing up the sheet; or, better still, take the jib in altogether, as most likely a change will have to be made. Get the end of the bowsprit on deck, take the gear off, and fit it to the bowsprit end again in the best manner possible.

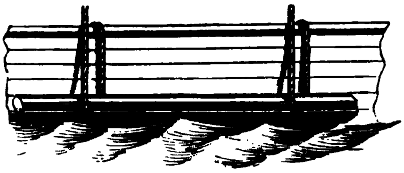

FIG. 84.

If the topmast should not be carried away by the loss of the bowsprit, try and save it. Let go the topsail sheet and halyards, and get the topsail down. Take the jib topsail halyards or spinnaker halyards forward, and set taut as a topmast stay, to steady the topmast.

CARRYING AWAY A BOWSPRIT SHROUD.—Let the jib sheet fly. Put the helm down and bring the vessel on the other tack immediately; if there is not sea room to keep the vessel on the other tack, let the jib run in and heave to. Then repair damage.

CARRYING AWAY A BOBSTAY.—Let the jib sheet fly and heave to. If it is the fall that has broken, the bobstay will have to be fished up and a new one rove. If the shackle on the stem or the bar is broken so that it cannot be repaired, and there is no second shackle or bar on board, the vessel must be sailed without a bobstay. Reef the bowsprit in, set a small jib, and do not sheet the jib too taut. In squalls, or when falling into a wave hollow, ease the vessel with the helm. Many fishing vessels, some of 80 tons, are never fitted with bobstays.

Carrying away a Topmast.—A topmast when broken invariably falls to leeward, and it would be very difficult to give directions for clearing the wreck away. It will hang by the topsail sheet from the gaff, by the tack over the peak halyards, by the backstay over the peak halyards, and by the topsail halyards if they were belayed to windward. In clearing the wreck and unreeving, be careful not to let anything go until it has been properly secured or lashed, so as not to tumble on deck.

Carrying away a Mast.—The best thing to do, if the weather is very heavy, is to unreeve sheets, tacks, lanyards, and tackles of shrouds, and ride to the wreck, as it will make a capital floating anchor. When the weather moderates, the mast can be got alongside, the gear cleared, and the sail got on board. In a large vessel the mast will probably be too heavy to handle, and will have to be made fast astern. In a small yacht the mast may be rigged as a jury mast. Supposing the mast has been carried away five or six feet above the deck, put the heel of the mast against the stump on the aft side so that it cannot slip; take the lower main halyard block forward to stem head; put guys on the masthead, and lead one to each side of the yacht. Lift the masthead, and set taut by the main halyards, and when the latter have got sufficient purchase hoist the mast to a perpendicular, steadying by the guys. When upright lash the mast to the stump, seize bights in the shrouds to shorten them, and set up by the lanyards. If the mast be worked round to the fore side of the stump, the boom gooseneck can be shipped as before. Set the mainsail reefed or double reefed as required, or set the trysail.

If the mast be carried away close to the deck, unship the stump, and step a spare spar to lash the heel of the mast to. Or the broken mast could be stepped. In this case it would be better to improvise sheers by taking a couple of spars, such as topsail yard and trysail gaff; and, after lashing their ends together, rear them over the mast hole, one leg in either scupper. A tackle should be lashed to the apex of the sheers for hoisting the mast by. Keep the sheers in their place by guys leading forward and aft.

Sheers might be used for getting the mast and boom on deck, or for rearing the mast on end at first by rigging them aft, when the keel of the mast is to be lashed on deck.

In case of a mast being carried away close under the hounds, preparations for getting the rigging and halyards aloft again can be made by throwing a line over the masthead, and hauling a tackle to pull a man aloft by. If the masthead is carried away, the main halyard block can be lashed above the rigging round the yoke. The peak hoisted by one of the topping lifts, or by a couple of blocks of the peak halyards, one to be lashed to the masthead over the main halyard block.

When the masthead is badly sprung above the yoke, but is kept from falling by the topmast, let fly the jib sheets, heave the vessel to, and lower the mainsail as quickly as possible. Lower the topmast half-way down, and lash the heel to the mast. Unhook main and peak halyard blocks, and unreeve jib halyards. Then prepare for rehoisting mainsail as if the masthead were carried away. The topmast will keep the mast head from falling.

Carrying away the Fore Stay.—Ease up fore and jib sheets, slack out the main sheet, and run the vessel off the wind. Put a strop round the bowsprit close to the stem, and set the runner up to it. We were once in a heavy wind in the Albertine, when both runners were carried forward in this way, and both in succession were carried away. An end of the cable was then hauled to the masthead by the foresail halyards, and a bight taken round the mast above the yoke. The cable was then set up through the hawse pipe.

Carrying away a Runner.—The greatest strain comes on the runners (by runners is meant the pendant, runners and tackle), when the wind is a little abaft the beam; and if the weather one is carried away, the vessel should be instantly thrown head to wind, and put on the other tack until the runner is repaired. The vessel should be met by the helm when head to wind, and not put on the other tack until the main sheet is hauled in. If there be not sea room to sail the vessel when on the other tack, heave to.

Carrying away a Triatic Stay.—If the triatic be carried away, and the mainmast does not go with it, put the helm up, slack out the main sheet, and run the vessel off the wind. Take the lee main runner forward, and set up. If there be a fresh breeze, stow the mainsail, and then repair the damage.

THE MANAGEMENT OF OPEN BOATS.

Small open boats must never be regarded as if they possessed the qualities of deep and heavily ballasted yachts. They should not be sailed "gunwale under" as a small yacht is, and the puff or squall which a small yacht can be sailed through with impunity, will necessitate the open boat being thrown head to wind with head sheets eased up, or off the wind with aft sheets eased.

No system of ballasting will much increase the range of stability of a boat—(by boat is meant something of the type of the Surbiton gigs),—and it must be clearly understood that it is not the initial stability, or the stiffness of the boat at small angles of heel upon which her safety depends, but upon her range of stability, that is to say upon the amount of stability or power to recover herself she has, when heeled to very great angles when the gunwale might be pressed under water. For competitive sailing, a boat to succeed must resist being heeled at all very potently, that is she must have great initial stability, so as to be able to carry a large area of canvas without heeling more than to a point midway between her water-line and gunwale. This stiffness is more dependent upon breadth of beam than upon the weight of ballast carried low, and an inexperienced boat-sailer finding a boat very stiff at first might be tempted into pressing her beyond the danger point.

On the other hand, depth of hull of itself does not add to stability, but by ballasting it does, and lengthens out the range of that stability so that a boat may always have righting power at any possible angle of heel, providing she does not fill with water and sink: (See pages 8 and 36.) Thus safety does not so much depend upon the great stiffness which enables a boat to carry a large press of canvas without heeling to any considerable extent, as upon the range of her stiffness or the continuation of that stiffness, even up to the time when she might be blown over on her beam ends. Now shallow open boats have a very low range of stability, and directly their gunwales are put under, they are likely to be blown over. A high side out of water in a large way increases the range of stability, and the higher, in reason, a boat's side is out of the water the safer she will be.

Boats are most frequently capsized in disturbed water, and the cause is generally ascribed to a sudden squall, or to the fact that the boat being unduly pressed, some of her loose ballast shifted to leeward. But a boat among waves might be, and no doubt frequently is capsized without any accession of wind or movement of the ballast.

It can be supposed that a boat is sailing with a beam wind, and with a beam sea, and that her inclination, due to the pressure of wind on her sail is 15°. If she got into the position shown in Fig. 85, she would practically be inclined to 30° and she would probably upset. Assuming that the boat had no sail set, she would not get into such a position, as she would accommodate herself to the wave surface and her mast would correspond to the perpendicular drawn to the wave surface (see Fig. 85). Even with sail set the boat would more or less so accommodate herself to the wave surface, minus her steady angle of heel; but the increased pressure on the canvas, due to the righting movement of the boat, which would have to be overcome, would prevent her recovering herself entirely. That is, if the boat be heeled to 15° relative to the horizon, or to the normal surface of the water represented by the vertical line, and a wave came to leeward as shown, she would be in the position of a heel of 30° relative to the perpendicular to the wave surface; but, inasmuch as the wind pressure is only capable of heeling her to 15° the boat would ultimately recover herself to that extent, and her mast would be represented by the vertical. However, long before a boat could so recover herself, she might be swamped or blown over.

With a beam sea a boat will roll a great deal, and this condition is a prolific source of accidents. If a boat is being sailed at a permanent angle of heel of 15°, and by the action of the waves she is made to roll another 15°, she will frequently be in the position of being heeled to 30°; and if the extreme part of the roll should occur jointly with such a position as shown in Fig. 85, the boat would inevitably upset.

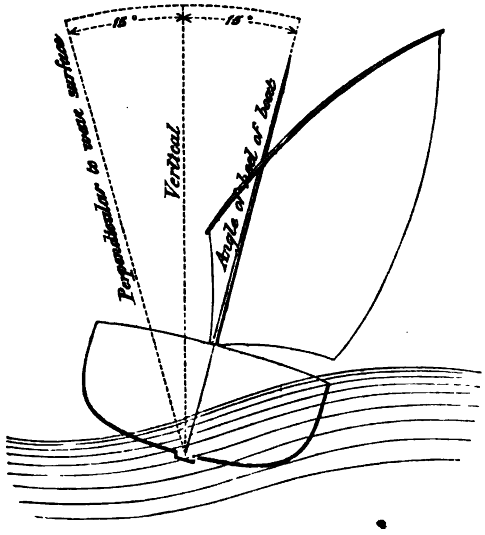

FIG. 85.

Next it can be supposed that the boat is being sailed at a permanent angle of heel of 15°, that she has an extreme roll of 15°, and that there came a sudden wind squall. Then if the extreme leeward roll, and the squall took place together when in the position shown by Fig. 85, she would blow over and nothing could save her. But she need not be in such a position as that depicted and yet be blown over: if the boat has a heel of 15°, and an extreme leeward roll of 15°, then if the extreme roll and a squall occurred together the boat would be upset, whatever her actual position among the waves, whether she was on the trough, on the side, or on the crest of a wave. Further it must be always understood that a force of wind which will, if applied steadily, heel a boat to 15°, will if applied suddenly heel her to double that inclination; thus it is not so much the force of the squall as the suddenness of its application wherein lies the danger.

When a boat is among waves (especially with a beam wind), ballast should not be trimmed to windward, nor should the passengers sit on the weather gunwales. The boat after being in a position similar to that shown by Fig. 85 will take a very heavy weather roll, may possibly fly up in the wind, be taken aback, and blown over.

It will thus be seen that there is very considerable danger attendant upon sailing a boat among waves, a danger perhaps not always understood. The canvas that will permanently heel a boat to 15° may be carried safely enough in smooth water with a beam wind, but the case is altogether different among waves, and so much canvas should not then be carried, perhaps by one half. Many ships' boats and pleasure boats are annually lost through recklessness in carrying canvas in rough water; and, although a boat may go out among waves a dozen times without being subject to either of the coincident conditions described, yet may she the very next time: so long immunity is not necessarily impunity.

In sailing among waves the ballast should be well secured, the passengers should sit in the bottom of the boat, and the main sheet should be kept in the hand. If the sea is abeam the boat should be watched very closely, and if a bigger wave than usual rolls in on the beam, ease the sheet and run off the wind a little, the wave will then pass harmlessly under the boat. Do not luff with a beam wind or sea, and in keeping away never forget to ease the mainsheet.

In sailing by the wind among waves the danger of being blown over will be considerably less, but nevertheless there is danger, and it must not be assumed that because an experienced and skilful boat sailer sails a mere cockle-shell safely about among waves, that anyone could do so without experience or skill. In boat sailing safety mainly depends upon knowing what is dangerous.

In sailing by the wind the mainsheet might be belayed with a slippery hitch, with the fall close to the hand (resting over the knee is a good plan) and the foresheet should lead aft. If there is much sea do not pin the mainsheet in, but the foresheet can be drawn fairly taut. Luff the boat fairly into the big seas that roll in on the bow, and fill her again promptly. The foresail will be found of great assistance in taking her head off, and hence it should be sheeted pretty flat. In puffs and squalls the boat should be luffed up and the foresheet eased, and always do this before the gunwale gets under; as when the gunwale goes under, the boat soon loses way and then the power of luffing will be gone, and the boat may perhaps fill and sink. If a boat does not come to quickly and relieve herself of wind, let fly the mainsheet and ease her that way, but recollect in all cases that whatever is done, must be done promptly.

If the boat has a mizen the main sheet can be eased at the time of putting the helm down, as the mizen will bring the boat head to wind, but generally in luffing for squalls the mainsheet need not be eased; but the foresheet should be, as that will allow the boat to fly to more readily.

If the boat has only a mainsail and mizen, ease the mainsheet in luffing if the squall be heavy, and leave the mizen to bring her to.

In luffing for squalls, should the boat get head to wind, haul the foresheet aweather, put the helm up, keep the mainsheet eased off and press down what is to be the lee quarter: (See foot note, page 185.) If the boat has only one sail, haul the boom on what is to be the weather side and put the tiller on the opposite side; as the boat gets sternway on she will pay off, then right the helm, ease the boom over and sail her. If the boat has a mizen as well as mainsail, the mizen sheet should be eased whilst the boom is held over. If an oar is handy, the boat can be helped off the wind by a "back-water" stroke or two off the lee quarter, or a stroke or two on the weather bow. But the boat sailer must not get nervous and throw his boat head to wind for every little catspaw or small sea; he must, whilst being careful that his boat is not capsized by a squall or filled by shipping water, sail her boldly but not recklessly, and keep her a "good full" or she will surely drive to leeward. It is particularly incumbent that a boat should be kept full when sailing among waves, hence the great necessity of her being appropriately canvassed. If the boat is sailing across a weather-going tide she may be squeezed a little, but never allow the sails to lift.

In tacking a small boat always remember that it is not the tiller of a big yacht that is grasped, and do not shove the helm down with all the force at hand; bring the boat head to wind with the tiller about half over, then put it hard up and ease again to amidships as the vessel gathers good way. With a big boom-mainsail a small boat in smooth water will shoot head to wind and fill on the other tack in less time than it takes to write it, but in a sea she may require some help, and the moment for tacking should be when a "smooth" comes on the water. If there is an uncertainty about the boat coming round, do not let go the foresheet until the boat's head is fairly off on the other tack. If the boat has no head sail haul the boom aboard as the helm is put down, and keep it to windward until she pays off. Never forget that a boat can always be helped round by an oar.

Above all things never attempt to tack with a big wave coming in on the weather bow.

Sailing along a Weather Shore.—In sailing along a weather shore, it is generally found safer with a boom-mainsail to luff up in the wind and ease the foresheet, if there be one, than to ease the mainsheet and attempt to relieve the boat without much altering her course; however, in sailing along a weather shore, like the bank of a river, there will be the risk of going stem on into the bank; and this will be especially awkward if the boat has a long bowsprit. It is not pleasant to go into the bank of a river, but it would be preferable to capsizing. Still, the boat can be relieved by letting the sheets go and running her off; but never deliberate as to what shall be done—that is, whether the boat shall be luffed up at the risk of running into the bank, or whether the sheets shall be eased and the boat run off the wind. Always remember in the case of squalls that "he who hesitates is lost."

Sailing Along a Lee Shore.—When sailing along a lee shore in squally weather (if it is a matter of choice, always work the weather shore), smartly luff up to the squalls in preference to easing the mainsheet, and thus keep the boat going. If the squall be very heavy, the foresheet should be let fly so as to bring the boat head to wind quickly. If the mainsheet is eased off much the boat loses way, and then by help of her foresail may take off against her helm and shove her nose ashore; so easing the mainsheet in squalls should be avoided, if possible, when sailing along the lee bank of a river or by the side of mud or sand flats. Generally the boat will "come to" quickly enough without the foresheet being eased; but, if the squall looks to have much weight in it, ease the sheet and luff up in good time; then prepare to lower the mainsail.

In lowering a sail in squalls, great care should be taken to spill the sail as it comes down, as, if it fills and blows out in bags, it may not only cause trouble in handing it, but upset the boat.

Running Before the Wind and Sea.—Running before a wind and sea in a small boat may to the inexperienced appear a very simple and safe operation; but, in reality, it is a very dangerous one, and many a small boat has been lost in attempting to "run away" from a sea. The two principal dangers will arise from getting by the lee and broaching to: the boat's head will be most likely to fall off to leeward, or rather her stern lift to windward, as a wave crest passes underneath her bottom from astern. But with equal peril she might have "broached to" as the wave crest lifted her bow; the boat's head will be turned towards the wind, and then, if she be not well managed, she will get broadside on to the waves, and the next roller will almost inevitably swamp her. If the rig be mizen, mainsail, and foresail, the mizen should be stowed before the boat is put before the wind; the lee foresheet should be belayed slack, and the weather one should be led aft. As the boat begins to fly to, haul the weather foresheet in, and put the helm up; but very frequently the helm is not of much use if the boat is among breakers in shallow water, as she will be carried along on the back of a comber. Thus it very frequently happens that a boat that has successfully battled with the waves in the offing comes to grief as she gets among the surf to try and effect a landing or to run over a bar into harbour. In running over a surf an oar off the quarter will be found much more effective than the rudder to steer with, but the oar should always have a line fast on it, and it should be belayed to the gunwale, in case it has to be left when the sail requires attention.

A small boat, if there is much wind, and especially if there be sea as well, should never be run dead before the wind, but with the wind a little on the quarter; then gybe over, and run on the other tack.

In gybing, always haul the boom well aboard as the helm is put up. As the wind passes from dead astern and comes on the other quarter, taking the boom over, shift the helm promptly and prevent the vessel flying to.

GENERAL CAUTIONS.—Great care should always be taken when passing under the lee of a ship at anchor or other large object, if there is anything like a breeze, as when the boat draws clear she will have but little way on, and to be met then by the full blast of the breeze will cause her to heel more than if she were moving at her best speed; or, if she has to go under the lee of a passing or meeting vessel, she will equally get becalmed, though not for so long a time; she will, however, get the breeze again much more suddenly than if the passing ship had been at anchor, and may consequently be knocked down more. None of the crew of a boat should ever sit on the gunwale when passing under the lee of a ship, as the sudden loss of wind will bring the boat upright, and so much weight on one side may cause the crew to be pitched into the water, or possibly, if the boat got caught aback as she heeled to windward, she might capsize.

The first best thing to do is to give all objects such a wide berth that the boat cannot be becalmed by them. If the boat is beating to windward, and would have to bear up very much to clear the ship at anchor, it would be better to make a board and weather the ship; this can also be done, if managed in good time, to weather a ship that is *meeting* the boat, *i.e.*, is running before the wind; but a boat should never be put across a vessel unless so far ahead as to render collision impossible. If in the attempt to weather a ship there seems a doubt about doing it, do not commence squeezing or nipping; ramp the boat along, and tack or bear up in good time and go under the ship's stern if both are beating, and under her lee if the ship is free.

If there be no choice, and the small boat has to pass under the lee of the ship, then have the mainsheet cast off and held ready and clear to run out; if the boat has nearly lost her way before she gets the breeze again she will scarcely answer her helm to luff; and if she is knocked down to near the gunwale edge let the sheet fly without hesitation.

If the passing vessel be a steamer going at a great speed, she will leave a considerable wash, and small boats should avoid this, although it is the delight of some boat sailers to get into it and ship "green water," as they love to call it.

If the boat carries lee helm trim her by the head a little, or if the mainsheet will admit of it harden it in and ease the foresheet a trifle; at all events so manage that the boat carries enough weather helm to fly up in the wind when the tiller is let go. If a boat carries lee helm she may refuse to come head to wind, and under some circumstances this might be highly dangerous.

A single hand should never attempt to row and sail at the same time; if occupied with rowing he cannot attend to the helm and sheets, and the prudent course would be to lower the sail and propel the boat entirely by oars. In case the rig includes a mizen or foresail, one or both could be kept set, but the foresheet should be belayed so that a slight pull on the fall will release it.

The crew of the boat should invariably sit on the bottom boards on the weather side, or if there be much sea amidships. No one should be allowed to climb the mast if the boat is under way, as the weight aloft might capsize her. Nor should any of the crew stand on the thwarts so that they might get thrown down in the lee side of the boat when she lurched, or otherwise imperil her safety.

In cases where the mainsheet leads through a block, through a bull's-eye, through a thimble, through a hole, or other similar arrangement, the boat sailer should ever and anon cast his eye on the fall of the sheet and see that there are no turns or kinks in it. If the fall be coiled up, see that the running part is uppermost and the end underneath. New rope and wet rope are specially liable to get foul turns in them. It will also be prudent to see that nothing like a boat's stretcher, mop handle, thole pin, or bailer lies in the coil of a fall of a sheet.

REEFING.—In reefing, the tack and sheet should always be shifted to the reef cringles before the foot of the sail is rolled up and the points tied. Always roll up neatly and as tightly as possible, not only for the look of the thing, but because otherwise the points for the second or third reef may not reach in case they are required. In shaking out a reef always untie the points and loosen the foot before shifting the tack and sheet.

ROWING IN A SEA.—The principal thing to avoid in rowing in a sea is getting broadside on to the waves; if a boat gets into such a position she may roll over or be knocked over or be swamped. If possible row head to the sea, and if the boat is carried too far to windward, take the opportunity of running her off whenever a smooth presents itself. In running before the sea the boat will most likely show a tendency to broach-to, and so get into the trough of the sea that way, this tendency must be instantly checked. In landing on a sea through a surf, it is frequently a good plan if the boat is not sharp sterned to row her in bow to the surf or stern first.

In boarding a vessel that is under way, always row up under her lee. In boarding a vessel at anchor, always bring the boat's head up to the tide, and take a good sweep in coming alongside. Give the order "In bow" when about fifty yards off, and "Oars" (the order for the men to toss their oars in), so that the boat shoots alongside with her way nearly stopped. Avoid if possible going stem on to a vessel.

As a rule a boat should always be beached through surf with her sails stowed, as, if she got broadside on among the breakers with sail up a capsize would be inevitable. Upon nearing the beach on a flat shore recollect that here the wave water itself is moving, and will carry the boat along until it finally casts her up on the beach: as each wave overtakes the boat care must be taken that it does not twist her round broadside on.

As the water at the stern may be moving faster than that at the bow, the tendency of the stern wave will be to turn the boat round if the wave does not take the boat fairly end on. This effect of the overtaking waves can be reduced by towing something astern—a spar broadside on, for instance, made fast to a bridle—and by approaching the shore stern first, so that the bow is presented to the overtaking waves.

If the beach is a steep one the best plan is to row in as hard as possible, choosing at last as the moment for beaching when a sea begins to break and pour in on the beach.

CHAPTER XXIV.

THE GENERAL MANAGEMENT OF A YACHT.

THE OWNER, MASTER, MATE, &c.

THERE is no code of regulations for the discipline of a yacht, but generally the custom of the merchant service is observed. The master is not required by law to have a certificate of competency, and frequently he is only capable of making coasting passages. However, many masters of large vessels are skilful navigators, and could take a yacht to any part of the globe. The chief requisite in a master for a yacht, whose cruising does not extend beyond the English and Irish Channels, is that he should be a thorough master of fore-and-aft sailing, and that he should be clean and tidy in his habits, able to enforce cleanliness and tidiness in the crew, have perfect command over the crew, and carry out the owner's wishes cheerfully and respectfully. Most yacht masters rise from "before the mast" after having served a season or two as mate, and generally they assume their new station with a full appreciation of its consequence—that is, they are alive to the serious responsibility of being in charge of a vessel—take her about with a caution and patience that is unceasing, and are always on their dignity in their intercourse with the crew. Some men, however, appear to be quite incapable of feeling that dignity, and at one moment are too familiar with the crew, and the next squabbling with them. Such a man should not have charge of a yacht, and if an owner wishes to cruise in comfort he will get a sailing master who, above all things, is "master of the crew," conducts himself as such, and is observed as such.

The master has sole control on board, subject of course to the wishes of the owner, who ought, however, never to have occasion to interfere with the discipline or working of the yacht. If the owner has any fault to find against the conduct, whatever its nature, of any member of the crew, he should make that complaint to the master; it will show the master that he is responsible for the discipline, good behaviour, and efficiency of the crew, and the crew will not have the opportunity of saying they do not know who is master or that the owner is master, and that the titular master is only so in name.* But if the owner observes any misconduct or gross inefficiency on the part of any member of the crew, and the master apparently does not notice it, then the owner should bring the master's attention to it, and, if necessary, insist on the delinquent being discharged. This will really strengthen the position of the master and inspire him to take command of the crew, instead of being content with a kind of slovenly discipline.

The owner should always keep up a kind of formality in addressing the sailing master, and address him as Mr. So-and-so, and not as Harry or John, as the case may be. The owner in this way can do a great deal towards inspiring the crew with respect for the master, as, if it is seen that the owner treats the master with a flippant familiarity, the crew will do so too. The crew should always address the master as "Sir," and not in an offhand way, such as "All right, skipper," or "All ready, captain."

If the owner wishes any work done on board, or requires the gig or boat, he should tell the master of his wishes or send a proper message to him, and not issue direct orders to the crew; all such usurpations of the proper duties of the master are subversive of discipline, and should be carefully avoided. If the owner goes on shore and wishes the boat to return for him, he should give the order to the master; but if he forgets to do this he should upon landing give the order to the coxswain, whose duty it will be to repeat the order; thus, if the owner says, "Come for me at half-past four," the coxswain will answer, "Half-past four, sir," to show that he understands the order.

The master should always ship the crew, and generally should be allowed to ship the mate as well.

The mate, like the master, should always be addressed as "Mr.," alike by the owner, master, and crew. When the master is on deck the mate's place is forward, and he superintends the setting and taking in sails, and generally sees that the master's orders are efficiently carried out. He also takes charge of the yacht's rigging, and sees that all necessary work is done upon it, and from time to time reports the condition of the rigging, spars, and sails, to the master.

When orders are given to get under way, he superintends all the necessary preparations for getting the anchor and making sail; so also in bringing up, he prepares for taking in sail and letting go the anchor.

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* In some small vessels the owner is actually master, and then he deals with the crew as such.

When the master is below, the mate goes aft and takes charge of the deck and issues orders as if he were the master; but, although it may be his watch on deck, he does not make any serious alteration in the vessel's course or shorten or set sail, or reef without informing the master of what he is about to do. Then if the master considers it necessary, he goes on deck himself, and perhaps summons his watch from below.

The boatswain takes charge of the sail room and ship's chandler's stores, sees that all the tackles, spare sails, &c., are properly stowed and in good order. With the mate he superintends the washing down, scrubbing, cleaning of brass work, and blacking down the yacht or rigging.

The coxswain of a boat has to see that she is kept clean and in readiness for use, rows the stroke oar when passengers are in her, and takes the yoke lines when only the crew. The coxswain of the owner's gig has usually one shilling or so a week extra for taking charge of her, and he, as before said, is held responsible by the master for her condition and the condition of every thing belonging to her.

WATCHES, BELLS, THE HELM, THE CREW.

WATCHES.—The master is always in charge of the deck, excepting when long passages are being made; then watches are set. The master takes the starboard watch, and the mate the port watch. The second mate is in the master's watch, or, if no second mate, the boatswain. The two mates generally tell the men off when they are shipped into their respective watches. If the yacht is short-handed in making a passage, the steward musters in the master's watch and the cook in the mate's. The watches are usually set at eight o'clock of the first night at sea, and the master takes the first watch; but on leaving a foreign port for home the mate takes the first watch. Following out the axiom that the "master takes the ship out, but the mate brings her home," the mate has charge of the navigation on the homeward voyage, if he is capable of the duty, the master superintending only.

When a yacht is in harbour, or when only sailing about in the daytime and bringing up at night, no watches are kept, and the whole crew, including master and mate are on deck. The master takes sole charge of working the yacht and generally steers. He issues all orders, and the mate sees that they are carried out. Thus, in working to windward, if the yacht has to be tacked, the master says "Ready about!" The mate answers "All ready, sir." The master then puts down the helm, saying "Helm's-a-lee!" the mate answers "Helm's-a-lee, sir!" and directs the crew to ease up the head sheets and haul them aft again as required. When the master hails with "Ready about," none of the crew should bawl out "All right, sir" or answer in any way whatsoever, but if the mate is not on deck, the second mate or boatswain should take his place, and see that the head sheets are worked properly. The master will see that the aft sheets are worked. With a good and attentive crew, the first hail of "Ready about," or even a sign, will send all the men to their stations, and the more quietly a yacht can be worked the better it will be for the nerves of the passengers.

In making long passages watches are set, and the master and mate take alternate watches, as before stated. The twenty-four hours are divided into seven watches thus—five of four hours duration, and two of two hours, the latter being called "dog watches" and always occur between four and eight o'clock in the afternoon. The object of having dog watches is to obtain an uneven number, as otherwise the same men would always be on duty in particular watches. During the dog watches a great deal of liberty is allowed the men, and the watch below as well as the one on deck do their own odd jobs, tell yarns, sing, and generally amuse themselves in such a way as is consistent with the good working of the yacht.

Generally when going to sea the first watch is set at eight p.m., and the master takes that watch. Eight bells are struck and the port watch retires below. At twelve o'clock (midnight) the port watch is called by the second mate or boatswain going to the fore hatch or scuttle, and hailing "Port watch ahoy!" or "Eight bells sleepers!" The watch below should answer "Ay, ay!" turn out immediately, and be on deck in five minutes. Any lagging is regarded as very bad form, and a man is looked upon with contempt who does not turn up on the first summons. The watch lasts from twelve till four and is termed the middle watch. At four a.m. the sleeping watch would be called in the same way, to come on deck and take the morning watch from four to eight, and so on for the forenoon watch, afternoon watch, the "dog watches," and first watch again.

Bells.—As a rule, "Bells" are only struck on board yachts between eight in the evening and eight in the morning, but in large yachts they are regularly struck all through the twenty-four hours, whether the yacht is at sea or in harbour. When in harbour, or at moorings, an "anchor watch" is kept by one man, whose spell is two hours, the port and starboard watch supplying the men on alternate nights. This watch looks out for any dangers that a yacht may be in, summonses the watch below if necessary, and strikes the bells.

The bells are struck in this way: one stroke (or one bell) is half-past twelve; two strokes struck quickly (or two bells) one o'clock; two strokes struck quickly, followed by one (or three bells), half-past one; a double two (or four bells) two o'clock; a double two and one (or five bells, half-past two; a treble two or six bells three o'clock; a treble two and one (or seven bells) half-past three; four double strokes (or eight bells) four o'clock. Then commences one bell for half past-four, two bells for five o'clock, and so on, eight bells being struck every four hours.

Helm.—When watches are set it is usual for one of the crew to steer, and not the master or mate. Two men out of each watch are usually selected (generally among themselves) to steer, who are known to be good helmsmen. Each man is at the helm for two hours, and this is called a "trick." When the time has expired the other man goes aft as four bells are struck. If he does not go immediately he is reminded by the hail "Spell O!" The man who relieves should always, if the weather will permit, come aft along the lee side, and, crossing over the tiller, come behind the other and take the lines out of his hand from abaft.

The man, as he gives up the helm, states the course as E.S.E., or "Full and by," as the case may be. It is the duty of the new comer to repeat the course, to show that he understands it, and the officer in charge of the deck, should be near to hear that the course is correctly given.

If the officer of the watch requires the course altered, he gives the course anew, as E. by S., or "keep her off," or "bring her to," or "no more away," &c., and it is the duty of the man at the helm, to repeat the order audibly, to show that he understands it. In bad weather, it is usual to place a second hand at the helm, and then the man whose trick it is, stands to windward of the tiller with the weather tiller line in his hand, and the other to leeward with the lee tiller line. He assists in pushing the tiller to windward, or hauling it to leeward, as occasion requires. Frequently a young hand is given a spell at the helm in light winds, in order that he may gain a knowledge of steering.

The Crew.—When an order is given to any member of the crew by the master or the mate, such as "Ease the fore sheet," or "Take in the slack of that rope," it is the duty of the man to audibly repeat the order to show that he understands it, as "Ease the fore sheet, sir," &c. While the crew are at work, or during the watches from 8 a.m. to 4 p.m., there should be nothing like "recreation" permitted on the fore deck or in the forecastle, but the men should go about their work quietly, never converse loudly, nor hail one another from one end of the vessel to the other. All orders should be obeyed instantly and cheerfully, with a ready response or a cheery "Ay ay, sir!" Nothing could be worse than for the crew when an order is given to sit and stare, and then to leisurely proceed to do it with an air which plainly says, "I am doing it, but you might just as well have done it yourself." In most cases, in working the yacht the master should give the order to the mate, who will direct the particular man or men who are to carry out the order. As before said, the order should be obeyed with alacrity; if it is not, it will appear that the men do not know how to execute it, or that they are so stupid that they do not understand it, or that they are such bad sailors that they do not know that a seaman's first duty is ready obedience.

Whenever any member of the crew shows the least slackness in executing orders or in any way neglects the ship's work, shows symptoms of insubordination, indulges in mutinous talk, gives insolent or even pert answers, he should be instantly warned by the master of the mistake he has made, and upon the second offence should be given his "discharge ticket." If a seaman obeys all orders promptly and executes them conscientiously, he will be respected by the master and other officers; but if he is doubtful in obedience and a sloven in his work, the master, very properly, will have a contempt for him, and will take advantage of the first opportunity for unshipping him.

The master should take every precaution to prevent drunkenness among the crew, and should never overlook more than one offence in a season. This rule should be observed with great strictness.

Smoking should be permitted on the fore deck after dinner and during the dog watches. Smoking should not be permitted at other times, nor should smoking be ever permitted below.

LIBERTY MEN, DISCIPLINE, &c.

As a rule, there is very much more difficulty in maintaining discipline on board, when a vessel is seldom underway. The yacht is in such thorough order, that after she is washed down, the brass work cleaned, and her sides "chamoied," there is nothing left to do, except perhaps row the owner on shore, and bring him off again. The men have nothing to do but eat and sleep, and as they cannot be doing this all day, there comes a longing for going ashore. The master, of course, has to be asked for "liberty," and if he refuses, the man has a fit of sulks, and takes the first opportunify of being insolent. This is frequently the origin of squabbling on board; but, on the other hand, sometimes the master allows too much liberty, and almost permits the crew to leave and rejoin the vessel, when they please. This is worse than no liberty at all, and usually ends with the men who stay on board from week's end to week's end, abusing those who are everlastingly on shore, and the result is a regular fo'c'sle row. The best plan is for the master, directly the yacht is in commission, to have some system about liberty. The usual plan is for the crew to have alternate evenings on shore, or "watch and watch," if circumstances permit; starboard watch goes on shore one night, and port watch the next.

It is useless to tell an owner that he should not keep his yacht at anchor for weeks at a stretch, but get under way every day; there may be a variety of reasons why he does not want to get underway, but one is enough, and that is, the yacht is his own, and he need only get under way when he chooses. As a rule, the master will know the habits of the owner, and only engage men who he knows can stand a life of comparative idleness and confinement.

A great many complaints are made about yachts' crews, and some very hard things have been said against them; no doubt many yacht sailors are ill-behaved, sometimes indolent, sometimes intemperate and dirty in their habits, and frequently shew an extraordinary spirit of insubordination. Now, we are not inclined to wholly blame the crews for this; in the first place, they are almost entirely untutored in anything like discipline, or the discipline they are used to is of the most slipshod character; there is no restraint on their habits, and if they exhibit anything like insubordination, the master, perhaps as ignorant as they are, has no code or system to guide him in restraining it. Again it must be understood that very much more is expected from a yacht sailor than from a seaman of the mercantile marine. He should be smartly built, be very active, be pleasant in his manners, and be as cleanly, as respectful, and well conducted as a highly trained man-servant; at the same time he must be a seaman. Now all that is required of a merchant sailor is that he should be a thorough seaman, and should shew no mutinous tendency; he may be as ill-shapen as Caliban, and as rough in his manner, and dirty in his person as a pitman, but no one will complain of this. He is kept in restraint by very severe laws, but the very nature of the characteristics expected in a yacht sailor forbids the application of the Merchant Shipping statutes to him in their integrity. A yacht sailor must be governed by quite a different hand, and in a large measure discipline and good behaviour on board must rest with the moral force of the master rather than with any restraints that could be employed under the Merchant Shipping Act. No Act of Parliament will make men clean in their persons, polished in their manners, or shapely in their forms; and a master in seeking these characteristics in a crew can only employ the means adopted for such ends in a household. He will take particular care, of course, that the men he engages are seamen; and he must exercise the same care in seeing that they are men who have the other qualifications of a yacht sailor.

We hear a great deal about men saying "this is not yacht rules," and "that is not yacht rules," but if the seamen venture to say this we immediately think that the master does not know what "yacht rules" are, if there be any such rules. We have already shown that such rules as there are for working ship, are in accordance with the custom of the Merchant Service, and should be, and we believe are, rigidly observed. The other rules for the good conduct and personal behaviour of the men must rest entirely with the master; if he has the moral force necessary to govern men he will have a happy and orderly yacht's crew; if he has not, and attempts to supply the deficiency by the application of statutes that were intended for quite a different condition of things he will always be master of a bad crew.

Masters as a rule have that necessary moral force, and the very fact that most of them rise from "before the mast" is evidence of this. And this brings us face to face with the fact that yacht sailors taken as a whole, are not the ungovernable and ill-assorted lot of men that we are sometimes asked to believe; and most masters exhibit a wonderful tact in maintaining what is not so much discipline as a ready compliance and respectful demeanour.

WAGES OF THE CREW—CLOTHES.

It is now usual to pay the master of a yacht by the year, and the wages vary according to the size of the yacht and the qualifications sought. Thus, the master of a 10-tonner may only have 50*l.* a year, whilst one in charge of a 100-tonner may have 100*l.*, and one in charge of a 300-tonner as much as 200*l.* Again, if a master for a racing yacht is required, very nearly as much will have to be paid for one to take charge of a 40-tonner as for one of 200-tons. Again, sometimes a master is paid so much a week whilst the yacht is in commission, and less whilst she is laid up; when such is the rule the master does not always keep charge of the yacht whilst she is laid up, but the owner pays a trifling sum per week—ranging from 5*s.* to 10*s.*—to a shipkeeper who may be an agent who undertakes such work, or a yacht sailor. In cruising yachts a common practice is to pay the master 2*l.* per week whilst the yacht is in commission, and 10*s.* when she is laid up; but the most satisfactory plan would appear to be to pay the master by the year, and make him live near the place where the yacht is laid up.

The remainder of the crew will be paid as follows:

		£	s.	d.
Mate	per week	1	15	0
Boatswain	„	1	8	0
Steward	„	1	15	0
Cook	per week	1	15	0
Seaman	„	1	5	0

The master, mate, cook and steward, live at the expense of the owner, and if a table is not kept for them they are paid board wages of 12*s.* each per week.

The seamen find their own provisions.

Often 1*s.* per week is kept back from the seamen's wages as conduct money, and if either commits an offence during the week the 1*s.* is stopped; the fine however is seldom inflicted, as few masters have the courage to enforce it.

The coxswain of the gig is usually given 1*s.* per week more than the other men, as before stated. The "dinghy man" whose duty it is to row the steward ashore, &c., for marketing, and to fetch letters off, and generally to do the carrying to and fro, also has 1*s.* per week extra.

The steward and cook sometimes have more than the wages given above, and sometimes less. In large yachts where a second steward is carried, the wages given to a good steward are perhaps as much as 2*l.* The second steward's wages will vary from 1*l.* to 1*l.* 10*s.* according to whether he is a man or a boy, and to his efficiency.

We have known a professed cook to receive as much as 5*l.* per week, but generally a sufficiently good cook can be obtained for 1*l.* 10*s.* or 1*l.* 15*s.* The clothes given to the crews are usually as follows:

MASTER.	£	s.	d.
2 blue cloth suits	8	8	0
1 cloth cap and gold band	1	1	0
1 silk neckerchief	0	6	0
1 pair canvas shoes	0	7	6
1 pair leather shoes	0	15	0

MATE.			
1 blue cloth suit	4	4	0
1 pair pilot trousers	1	1	0
1 frock	0	10	6
1 cap	0	5	0
1 neckerchief	0	5	0
2 pairs of shoes	1	2	6

BOATSWAIN.

Similar to Mate.

STEWARD.	£	s.	d.
1 blue cloth suit	4	4	0
1 serge suit	3	3	0
1 neckerchief	0	5	0
1 cap	0	5	0
2 pairs of shoes	1	2	6

COOK.

Similar to Steward.

SEAMEN.			
1 pair pilot trousers	1	1	0
2 pairs of white duck trousers	0	10	6
1 serge frock	0	10	0
2 white duck frocks	0	12	0
1 cap	0	5	0
1 red cap	0	1	6
1 straw hat	0	4	0
1 hat or cap riband	0	1	0
1 neckerchief	0	5	0
1 pair canvas shoes	0	7	6
1 pair leather shoes	0	10	0

Sometimes the master is given only one suit of blue cloth.

If white duck suits are not given to the men, it is usual to give them a dongaree suit of blue linen to do their rough work in, and an extra pair of pilot trousers.

Very frequently, especially in small yachts, only one suit is given all round, with one pair of shoes. Thus the crew's outfit largely depends upon what the owner considers it necessary to give them.

It has been established over and over again in law courts, that the clothes are a livery and belong to the owner, but it is the custom to allow the men to take them away when the yacht is paid off. If a seaman is discharged for misconduct his clothes are retained. If he takes them away he can be sued for the value of them in the County Court.

YACHT RACING.

One of the principal causes of success in yacht racing is that of being "always ready;" ready with the entry, ready with the vessel whether she requires copper scrubbed or trim altered, ready with the sails and gear, ready with the instructions, ready in getting into a berth, ready to start, ready for every shift of canvas, ready for every evolution in sailing, and ready to receive the first gun at the finish. Therefore, always be ready and never be above being prepared. The experienced racing man knows that if he is prepared with his spinnaker, and another man is not, after bearing up round a mark, that an enormous advantage will be gained. Or in hauling round a mark if he has got everything in time made snug, and sheets laid along and manned ready for rallying aft, and another man has to luff round with everything adrift on deck, and the boom off the quarter, his vessel will get a quarter of a mile out on the weather of the sloven, before the latter has got his boom aboard or jib sheets in. If proper preparation is made for every shift of canvas or manœuvre in sailing, the vessel will be worked as if all the gear and sails were parts of machinery, but if no preparations are made, everything will be in confusion on board; there will be shouting and bawling and running about, sails sent up head downwards, sheets and halyards bent on foul, or fouled among the numberless coils of ropes on deck, the crew will be distracted, the sailing master hoarse and furious, and the owner mortified to see such an utter want of discipline and system on board his vessel. On the other hand, if everything is ready beforehand, the crew will understand exactly what they have to do, each man will fulfil his task with a cool head and ready hand, the sailing master will be tranquil and manage the vessel cleverly, and the owner will be delighted, and think that half the pleasure of match sailing is in seeing a good crew, who know their work, set about it in a seamanlike and systematic manner. There must be no shirking; whatever a man is set to do, he must do thoroughly, and with a will; if he does not do this he should be unshipped without compunction, as one lazy, slovenly, or half-hearted hand on board will spoil three good ones.

Now everyone knows that there are various things to be done in yacht sailing at one and the same time, and it will be patent that it is desirable that each thing should be done by the same hands each time, if possible. Nothing looks worse on board a racing yacht if when such a simple order as "check the foresheet a trifle," a half a dozen men or so jump up and rush into the lee bow, when one of the crew could have quietly executed the order. On the other hand it shows a worse spirit if the men begin talking among themselves as to who shall go to do it; but if one hand is told off as the foresheet man, he will know that he has to check the sheet, and if the sheet has to be got in instead of eased, the mate will send another hand or more to help. For the more important stations men always are told off; thus one hand is always selected for masthead-man, bowsprit-end-man, &c.; and so far as the number of the crew will admit, there should be a just and effective division of labour.

CREWS.

Under the Y.R.A. rules, there is no restriction as to the number of hands a yacht may carry in a match, and this plan is found to work best, as no sailing master will carry more hands than are absolutely necessary, and if crews were limited, sails must be limited also, or a yacht would be frequently short handed. The only argument used in favour of limiting hands, is that a man with a lot of money and a disposition to spend it, would, by carrying a number of hands, get an advantage over a man with less money or differently disposed about spending it. The plain answer to this is that no sailing master ever dreams of carrying more than the necessary number of hands, and every yacht should be allowed to carry that number.

Attempts have been made to lay down a rule for so many hands for so many units of a yacht's tonnage, but any such rule fails, for the reason that although one man to every 5 tons may be a good proportion for a yacht of 100 tons, yet one man would not be sufficient for a 5-tonner. For match sailing, the following table will be found to accord pretty regularly with practice. Pilot is not included.

Size of Yacht.	Ordinary Crew.	Extra Hands.	Total Racing Crew.	Extra Hands, Amateurs.	Total with Amateurs
5	1	3	4	4	5
10	2	3	5	5	7
15	2	4	6	7	9
20	3	5	8	8	11
40*	5	5	10	9	14
60*	7	5	12	10	17
75*	8	6	14	—	—
100*	10	8	18	—	—
125*	11	9	20	—	—
150*	12	10	22	—	—
175*	13	11	24	—	—
200*	14	12	26	—	—
225*	15	13	28	—	—
250*	16	14	30	—	—
275*	17	15	32	—	—
300*	18	16	34	—	—

* This does not include cook and steward.

The number of the ordinary standing crew given, is somewhat in excess of what a cruising yacht would carry, but as the spars, sails, and gear of a racing yacht are so much heavier, the crews must be heavier also.

For racing it will not matter what the rig is, whether cutter, schooner, or yawl, the same number of hands will be required. In a cutter, the sails, spars, and gear are heavier to handle than in a schooner, or yawl of similar tonnage, on the other hand, the number of sails and the extra gear of a schooner or yawl require more hands.

A sailing master will generally endeavour to make up a crew from men who have been in a racing yacht before; this of course cannot always be done, and it follows that somebody must ship the green hands. However, excepting the circumstance that a hand who has been in a racing yacht is already "proved and rated," there is no disadvantage in having one or two green hands, as a couple of matches will make them perfect, if they have been trained as good yacht sailors in other respects. Men widely differ in their smartness and in their habits; and a man may be tolerated in spite of his moral delinquencies and faults of temper, because he is a very smart seaman, but a sloven should be given a very wide berth, as he will not only be offensive to the rest of the crew, but in all probability no seaman. As a rule, the smartest men are the most cleanly in their habits, the most prompt in doing their work, and in obeying orders, and the most satisfied, not to say proud, of their lot. On the other hand, a sloven is dirty in his habits, indolent, slow in obeying orders, and an inveterate grumbler. He quarrels with the catering, with the work he has to do, with the liberty he gets, and with the places he visits. Such a man should find no berth in a racing yacht, and if a sailing-master unfortunately ships such a creature, and does not instantly unship him when his character is patent, that sailing-master will not be doing his duty to the owner, to himself, or to the rest of the crew. It is frequently said that the men who come from this place, or that place, are better or smarter than others; but this is entirely a mistake. Good Cowes men are as good as good Southampton men; good Colne men are as good as either; and as there is no difference in the degrees of worth of the men, so is there no difference in the degrees of their badness. At Cowes, or Southampton, if a man is shipped who has never been in a yacht before, the probability is, that he will be no seaman at all. If such a one is shipped from the Colne, the probability is that he will know a great deal about seamanship as represented by a smacksman, but he will be a rough hand, and if he has to work upon rigging, or in any way assist in fitting out, his work will be rough; his manner will probably be rough also; he will handle things roughly, and may possibly have a perpetual desire to smoke, and perhaps will expectorate on the deck, and show a partiality for the after part of the vessel. This man will never much improve in his habits, but he will be good at hauling, good at belaying, good at reefing, and good and trustworthy in bad weather.

The question of "racing money" or the extra money given to crews on racing days, has long been a vexed one. Formerly it was 1*l.* all round and 5*l.* for the skipper, but during the last quarter of a century, the practice has sprung up of giving the men 10*s.* for racing and losing, and 1*l.* for racing and winning. The sailing master is rewarded by a per centage on the nominal amount won (generally 5 per cent.). It need scarcely be said that the yachts which observe this arrangement, are more in favour among the men than those which only give the 1*l.* for winning, and the result is that those who ship in the latter have a standing grievance unless a prize is won for every start. A few owners who are green at racing appear to place an undue value upon the exertions of a crew, and when victory is secured reward the sailing master and crew out of all proportion to their services. The answer may perhaps be made that the importance of the services is proportionate to the desire of the owner to win; this may be so, but the practical effect of such excessive liberality on sailing masters and crew, is to make the former foolishly vain and presumptuous, and the crew insolent and indifferent about everything but racing. Fortunately this evil appears to work its own cure, as the owner soon finds that instead of winning more prizes by paying liberally or foolishly, he wins less and finds that his vessel and crew are hated with undisguised zest by the crews of all other vessels.

If racing money is given at all, the 1*l.* for winning and nothing for losing system does not seem just. A vessel cannot win by the exertion of the crew alone, and if she could, it may be taken for granted that the crews would exert themselves to the utmost without the stimulus of extra pay. A yacht's success depends upon her excellence compared with the excellence of other vessels, upon her canvas, upon her sailing master and crew, and upon the varying fortune of wind. It therefore does not seem just that if a crew exert themselves to the utmost and lose, that they should have nothing, whereas if they had won, a douceur of 1*l.* to each man would have been given. It may be argued that many owners would not race if they had to pay 10*s.* losing money, because they know that their vessels are not so good as some others, and therefore that their chances of winning are more remote. This may justify the owner in not racing, but it is hardly fair to the crew if he does race. If the 1*l.* winning money is fairly earned, the 10*s.* losing money is equally well earned, and the difference of 10*s.* between the two douceurs is quite sufficient to keep up the desire to win. But there is still another very strong argument to be advanced on behalf of the 10*s.* losing money plan. The extra men get 10*s.* for coming on board to race, and if these men are given 10*s.* besides their ordinary day's pay to come out of a strange vessel, it certainly is no more than just that the regular crew of the yacht should have 10*s.* besides their day's pay as well. The extra men have comparatively little work to do beyond the pulling and hauling during the race, but the regular crew of the yacht have most likely a hard day's work before the race, and a harder one after the race. It is not the fact that the work is no harder on board a racing yacht that on board a cruiser; in reality there is no comparing the two, and the life on board a cruiser is ease, luxury, and indolence, compared with the worry, discomfort, and work on board a racing yacht. We therefore think that the general practice of giving racing money is a just one, and that it should be apportioned as follows: 1*l.* for racing and winning first prize, 15*s.* for racing and winning second prize, and 10*s.* for racing and winning no prize. If the losing money is not given, only 10*s.* should be given for winning.

MANAGEMENT OF MATCHES.

The first rule of the Yacht Racing Association, is that "all races and all yachts sailing therein, shall be under the direction of the flag officers or sailing committee of the club under whose auspices the races are being sailed." All matches are to be subject to their approval, and they have the power to settle all disputes, and their decision is to be final, but they may "upon the application of the parties interested, or otherwise, refer the questions at issue for the decision of the council;" but there can be *no appeal* from the decision of the flag officers of a club, or sailing committee to the council, nor can a party interested in a dispute demand as a *right* that the matter shall be referred to the council, the option of so referring disputes to the council rests entirely with the flag officers or sailing committee. However, the practice is, where both disputants request it, for the flag officers or sailing committee to refer the dispute, and in most cases such a request from one disputant has been complied with. Also in cases where a general principle is involved, or where none of the Y.R.A. rules appear to clearly meet the matter in dispute; or where the reading of a rule is doubtful, or is open to more than one interpretation, the flag officers or sailing committee have of their own accord referred disputes to the council.

However, whenever the cause of a dispute is clear and whenever a rule exactly meets the case, or whenever there can be no question that a breach of a rule has been committed, the flag officers or sailing committee should decide the case for themselves. They should apply the rules as stringently as possible, but at the same time should remember that the rules were founded upon the principle of "fair play" only, and were not intended to be penal in their operation; exemplary penalties or decisions should be avoided; on the other hand, that class of protest which has been aptly termed "frivolous and vexatious," should be discouraged.

In most cases breaches of rules are more or less the result of accident or errors of judgment, and in giving decisions regard should be taken of the character of the breach, and of the manner of its occurrence. But a protest should not be dismissed for the mere reason that it has had no effect on the issue of a race, although in certain instances that feature could be properly considered; still in the majority of cases it is impossible to say how far a breach of the rules has influenced a result, even though it be such a trifling matter as carrying an anchor on the bow in a "cruising trim race" or "side lights in a race at night." It is no excuse to say that a breach of a rule was the result of an error of judgment, carelessness, forgetfulness, or ignorance; no such pleas are admissible; nor should it be overlooked that a rule may be designedly and persistently broken. On the other hand, a rule might be broken through an entirely accidental cause; such for instance as a delay in the delivery of an entry, or the dragging of moorings; such breaches might reasonably be overlooked, if satisfactorily accounted for; but if a yacht crosses a line too soon through an error of judgment, or touches a mark through an error of judgment, or fails to start with an anchor on the bow, and fails to carry one all through the race, such errors of judgment or persistent breaches of rules could only be regarded adversely.

POSTPONEMENT OF RACES.

The flag officers or sailing committee can only postpone a race on account of unfavourable weather, such as a calm, a fog, or a very heavy wind.

ENTRIES: POST ENTRIES.

Many a time an owner has been disappointed in sailing because his entry arrived too late, and he should recollect that by the Y.R.A. rules, a yacht must be entered for a match at *least* forty-eight hours before noon of the day appointed for starting the race. But a longer time may possibly be required, and in inserting the dates of a match in a diary, the date of closing the entries should be inserted as well.

A club cannot accept post entries, but sometimes a yacht is allowed to start upon the other competitors signing a paper that they do not object. If this were not done and the post entry won the prize, the club or regatta committee could be sued by the owner of the second vessel, who could thus recover the amount of the prize.

Entries can be made by telegram, and it is considered a sufficiently good entry if proof is given that the telegram was despatched or handed in *before* noon of the day on which the entries closed. So also if it can be *proved* that a letter was posted in such time that the entry ought in the ordinary course to have arrived before noon of the day on which the entries close, the entry is considered a good one. A plea of forgetfulness, or a general statement that somebody was "told to enter the yacht, and forgot to do it, or neglected doing it," does not justify the acceptance of a post entry.

Post entries are condemned for two strong reasons; in the first place they are disliked by the owners of the yachts that have already entered in good time; in the second place, they are disliked by clubs and regatta committees, because owners are induced to hang back until the last moment to see if the weather will suit their yachts, or to see if they can arrive in time to sail. The chance of swelling an entry by admitting a late comer, that legitimately had not deferred entering for any of the above reasons, is a very remote one, and post entries are now rarely heard of.

A yacht cannot be entered for a race under two rigs, but if there are two or more distinct races at the same time, or a prize for each rig, she can enter under a different rig for each. If it is a race where there is an "allowance for rig," a yacht cannot be entered under different rigs. In a race where there are distinct prizes for more than one rig, and where the rig of the "first yacht in" determines the rig of the winner of the principal prize, an owner may enter a yacht of each rig, but in no case can two yachts of the same rig be entered in a race.

In *all* cases the form of entry provided by the Y.R.A. should be signed by the owner or his representative before the race is started. So also in all cases should the declaration that the rules have been strictly observed be signed before a prize is presented.

INSTRUCTIONS.

Sailing committees should be very clear in the instructions they issue as to the manner of starting and the course, and in no case should verbal instructions be given, nor should verbal alterations be made to written instructions.

A sailing committee can, however, if they so choose, issue verbal alterations to instructions; but such alterations, the same as all other alterations, should be delivered to every competing yacht in the race, otherwise the race would be rendered void upon protest.

A secretary, acting under the direction of the committee or flag officers, can deliver verbal alterations or instructions; but such alterations or instructions would render a race void, or cause the yacht or yacht's acting upon such verbal alterations or instructions to be disqualified under a protest, if it were proved that the secretary had acted without authority or direction from the flag officers or sailing committee.

STARTING.

There are two ways of starting yachts in a match, one from anchors, or moorings, and the other under way; the latter is frequently termed a flying start.

If the start is from anchors or moorings, the yacht should be taken to her station in good time; and to wait for a yacht that is late at her station is hardly fair to those that are in time.

It will be assumed that the race is for 10-tonners; and, as the method of starting and general conduct of a race is the same for yachts of all sizes, a 10-tonner will serve to "illustrate a race" as well as a 100-tonner. If the start is from moorings, go up to the buoy to pick it up just as you would to pick up any other buoy. If the yacht is before the wind, lower all sail and go up to the buoy with way so much deadened that the yacht scarcely moves, due allowance of course always being made for tide, whether foul or fair; in beating up to the buoy, the yacht must be rounded to and made shoot head to wind up to the buoy. Get hold of the buoy and hawser and haul about ten or twelve fathoms on board, then bend on the quarter spring, veer out the hawser again and belay the spring with some slack aft. In starting from anchors to slip the chain the spring will be bent on the same way. If the anchor has to be weighed, no spring will be bent on. If a yacht starts from her own anchor and slips and the anchor has to be got by a boat, it is best to bend a trip line to the crown of the anchor with a buoy. Also if the anchor has to be weighed in a five tonner, it will be found best to put a trip line on the anchor and pull it up this way regardless of the cable, which can be got in at leisure.

Do not haul too much of the hawser in, as the yacht may drag, and this would render her liable to disqualification; neither get the rudder hard across, as that will bring the stream of the tide on one bow, or on the broadside, and the force of the stream acting on such a surface may cause the yacht to drag, and this would render her liable to disqualification.

If the start is to be made to windward with the tide, everything must be got ready for such start long before the "five-minutes gun." Sometimes when starting from moorings or anchors, permission is given to set after canvas prior to the gun for the start being fired; but if the yacht is riding head to the tide the wind will blow astern, and if she had her mainsail set she could not keep at her moorings. In such cases the sail will not be hoisted till the last two or three minutes.

The breeze we will assume to be of whole-sail strength, that is that the biggest topsail, not being a ballooner, can be just carried to windward. See that the topsail is bent to the yard and that the halyards are properly bent; also bend the second topsail and stow away with the other spare spars on deck "ready when wanted." Lay No. 1 jib out on the bowsprit in stops and hook on the halyards; get the mainsail (with boom well topped) and the foresail ready for hoisting. If the jib topsail will be wanted hank it on to the topmast stay, stow it on the bowsprit end and reeve the sheets.

See that everything is stowed below that will not be required on deck, and also see that everything that is on deck and not in immediate use is securely lashed. Have an axe ready to cut the quarter spring in case it jammed.

At the five-minutes gun place the crew at their stations.

First the helmsman of the day takes the helm; with him aft will be the pilot, who will also look after the quarter spring and attend to mainsheet; the mate will cast off the spring or hawser forward, clear the jib-halyards for hoisting, and with another hand hoist the jib and take in the lee sheet; one hand will hoist the foresail and attend to the lee foresheet if necessary; two hands will man the peak halyards, and two the throat. This will be work for eight hands; if the pilot is not allowed to work, the jib-halyard hand will go aft and cast off the spring and jump forward directly it is done.

When the gun fires everything must be done at once. If the yachts have to cast on starboard tack the helmsman in the last fifteen seconds will put his helm to port, so as to make sure of the wind catching the yacht on the right starboard quarter. As the gun fires the mate will throw overboard the bow fast, and as the quarter spring is not likely to be wanted now, the pilot will throw that overboard also; all hands will hoist away. The pilot will overhaul some of the mainsheet and drag it in again directly the yacht begins to move through the water, and the helmsman will gradually bring her to the wind. Get all the sails set as quickly as possible is advice that cannot too often be repeated, and when they are so set coil up all ropes, &c., and "clear the decks."

In starting every caution must be exercised to avoid fouling other yachts; but frequently a foul cannot very well be avoided if the vessel has no way on, and is simply moving with the tide; but if the vessel has gathered way she is under control, and no foul should take place.

If the yachts are to proceed against wind and tide, and to cast on starboard tack (*i.e.*, cast to port), the helm will be put to starboard just before the start, in order to sheer the yacht's head to port or off the wind (in reality the stern will come more to windward, then the bow will go off to leeward). The quarter spring must not be let go until it is seen that the vessel is casting all right. Great exertion must be made to get the mainsail up quickly if it is not already set.

In all cases, where the state of the tide and wind admits, after canvas should be allowed to be set prior to the starting gun, as generally, where a start has to be made with all canvas down two or three extra hands have to be carried for the sake of getting up the canvas. Years ago a number of hands were engaged to assist in hoisting canvas, and directly the canvas was up these extra hands were turned out into a boat waiting alongside; to meet this a rule was made that no one should join or leave a yacht after the preparatory gun. The Y.R.A. have modified this by limiting its application to paid hands.

In starting to run with the tide and wind, hold on the quarter spring until the vessel is fairly swung round before the wind. If to run before the wind against the tide no quarter spring will be required, although one is generally bent on. In all cases get the canvas set as quickly as possible, and directly the hands who are hoisting the head sails have got them up hand taut, they should jump on to the main and peak halyards; the purchasing will be done after the sails are fairly hoisted all round.

In starting under way great care must be exercised that *no part* of a yacht (her bowsprit, booms, and sails included) is on the line before the signal to start. The strength of the tide and the wind should be so well judged that the yacht can, with full way on, go over the line at the very moment the blue peter is lowered and the gun fired. In all cases the master should strive for a weather berth, especially so if the start is for a thrash to windward. If the yacht is a little too early she must be stopped: yaw her about; haul the foresail up to windward; haul the main boom in, or if the vessel is by the wind it can be run well off her quarter—this only if there be plenty of help to get it in again. In extreme cases the yacht can be put about, but she should not wear unless there be a lot of time, as it will take her right away to leeward.

If the yacht is on the wrong side of the line when the gun fires she must be careful to keep clear of all yachts that are crossing or have crossed the line properly; so also must it be recollected that in underway starts all yachts are amenable to the sailing rules directly the preparatory (five minutes) gun has been fired; and one of the rules is that yachts coming into position from the wrong side of the line after the signal to start must keep clear of yachts which are starting or have started properly.

Whether the start be from moorings or under way the master should, to the best of his judgment, get the exact canvas up at first that can be carried; and if it is a case of reefing, always remember that it is a great deal easier to let a reef out than take one in.

If it is to be a start before the wind, a reef may be required when the yachts draw on the wind; in such cases the practice is to start with a reef down and jib-headed topsail over it; then when the yacht is brought by the wind the topmast is housed, or got on deck if the rigging is fitted on a funnel (see page 103).

HEAD-REACHING AND WEATHERING

The yachts in the match are assumed to be close-hauled standing on starboard tack on their first board in the beat for No. 1 markboat; jibs have been purchased up till the luff is as straight as the forestay, peak purchased up, main tack bowsed down, topsail sheeted home, and sails trimmed to the very inch for length. The water is just squeezing through the lee scuppers, and the helmsman has plenty of weather helm to play upon in luffing to the "free puffs."

Here are two boats that started abreast of each other, but one a hundred yards or so to leeward. The one in the lee berth holds much the better wind, and is gradually eating up to the other and head-reaching too. At last she is close up under the lee bow of the craft to windward, and in another half-minute her weather quarter-rail promises to strike the bowsprit or lee bow of the other; which has to give way?

To begin with, we must clearly understand what is taking place. Close-hauled means sailing so close to the wind as a vessel can be sailed with a view of economising distance or time, or both, in reaching a particular object. The vessel that is "weathering," and at the same time head-reaching, can in this case be taken as a standard for the condition of being close-hauled. It is thus quite clear that the vessel to windward does not fulfil that standard, and is in the condition—an uncontrollable one it can be admitted—of bearing away on the other. This, under Rule 22 of the Y.R.A. (the Luffing and Bearing Away rule), a yacht is not allowed to do, and she must luff up to enable the other to clear her. However, the general practice in such a case is for the leeward yacht to be given weather helm to keep clear of the one to windward; then when she has drawn clear ahead the weather tiller lines can be eased, and she will literally fly out across the bow of the other. This, on the whole, is the better course; and further, it is the course that must be followed if the leeward yacht head-reaches from astern, as by the Luffing and Bearing Away rule "an overtaking vessel, if to leeward, must not luff, so as to interfere with the yacht she has overtaken until she has drawn clear ahead."

It may possibly be argued that the leeward yacht is not luffing, that she is (for her) only a bare close-hauled, and that it is the windward yacht that is bearing away. Such a dispute could be only settled in one way: the leeward yacht was in the position of the overtaking vessel, and should have kept clear of the yacht to windward. Therefore in all cases if the leeward yacht is head-reaching, and at the same time weathering, we think it is good policy for her to keep clear of the yacht she is likely to foul to windward. It will not do for the yacht to defer using a little weather helm until her weather quarter is so close under the bow of the yacht to windward, that the fact of putting her helm up would have the effect of swinging her quarter on the bow of the other.

But it may happen that the yacht which is to windward is head-reaching, although not holding so good a wind as the other; in such a case the yachts may converge, and the lee quarter of the windward yacht may be likely to foul the weather bow or bowsprit of the leeward yacht. In this case it will be the duty of the windward yacht to keep clear of the one to leeward, as she is in the condition of a yacht bearing away, and is the overtaking yacht and must keep clear of the other; and moreover, by the rule before referred to, a yacht in the position of the one to leeward, that is being overtaken, may luff as she pleases to prevent another passing to windward; and further, when two yachts have the wind on the same side, and if no question of overtaking is involved, the yacht which is to windward must keep clear of the other.

If the windward yacht has deferred luffing until such time as the bowsprit end of the other is close to her lee quarter, it will be too late to luff, and a little weather helm will probably take the yachts clear. The leeward yacht will be pretty certain to have been well blanketed by the one to windward; her way will therefore be stopped, and the other, under the influence of her weather helm, will lift her stern to windward and forge clear.

When the leeward yacht is passed like this, it will be a good time to choose for getting a pull on any of the purchases that may require it. If the yachts are not too close when the blanketing takes place, it is the practice for the leeward yacht to put the helm down as the sails begin to shake, and make a shoot to windward clear of the wash of the other; but care must be taken not to keep the vessel shooting so long as to lose her way, as she might get in irons.

PORT AND STARBOARD TACK—CROSS TACKING.

One of the most frequent causes of protest arises out of the rule that provides for keeping vessels clear of each other when crossing on opposite tacks. The Y.R.A. rule is simply that of the Board of Trade, which says that "when two yachts are crossing so as to involve a risk of collision, then, if they have the wind on different sides, the yacht with the wind on the port side shall keep out of the way of the yacht with the wind on the starboard side."

In the first place, it must be clearly understood that the rule was not intended to put any penalty or odium on a vessel for being on the port tack; the rule was solely intended to keep yachts clear of each other, and for this purpose it was necessary that the rule should say which of two positions should be the one which must always yield. It was decided that the port tack should be chosen, but there could be no particular reason for preferring the port tack to the starboard tack for the purpose. It undeniably gives an advantage to starboard tack, and often, so far as match sailing is concerned, a seemingly unfair one; and hence, perhaps, there is often some feeling imported into the situation when two yachts are crossing on opposite tacks.

A yacht on the port tack may be so far ahead of the one on the starboard tack as to be able to almost cross clear ahead of her, but not quite. If there is the least doubt about it, the yacht on the port tack must give way however hard or apparently unfair it may seem for her to do so. If she does not so give way and fouls the other yacht, or if that other yacht has to bear away or luff to avoid a collision, the yacht on the port tack must be disqualified without hesitation.

But frequently the yacht on the port tack could have crossed clear ahead of the yacht on the starboard tack, providing the latter had not luffed at the last moment, and by so luffing succeeded in striking the lee quarter or boom end of the yacht on the port tack.

Apart from the obligation* of conforming to match sailing rules, if it were proved in court that no collision would have happened if the vessel on the starboard tack had not luffed, the decision would be that the vessel on the port tack should not be liable for any damage done to the other vessel: or that each vessel should pay her own damages. The Board of Trade rule is that, when one of two vessels has to keep out of the way, the other shall hold a steady course, and also that no vessel shall neglect any ordinary precaution in special cases. *On the other hand, the decision of a sailing committee would properly be that the vessel on the port tack was alone in fault. In competitive sailing, the temptation to make close shaves is very urgent, and any decision which would tend to encourage such practices should be avoided as the risks are so great.* By the Y.R.A. rule the yacht on the port tack is bound to give way if a *risk* of collision is involved. It is usual for the vessel on the starboard tack to "nip" a little when one on the port tack is coming for her; and this tells the vessel on port tack that she must not expect her to give way. If, however, a vessel on the port tack is crossing just clear ahead of the other, and that other luffs and touches the quarter of the vessel on port tack, the case is somewhat altered, and involves wilfulness; *but the answer manifestly is that the vessel on the port tack is not justified under the rule in placing herself in a position*

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* If two yachts agree to sail under and be bound by particular rules, such as those of the Y.R.A., and whilst sailing under them a collision or damage occurred, it would not be right to repudiate such a contract for the sake of appealing to another set of rules which might be different.

where the other can touch her, as the risk of collision is clearly involved However, as the rule was not intended to give a special advantage to the vessel on starboard tack, she should not needlessly bully the unfortunate one on port tack by luffing for the *purpose of making a foul.*

The right of luffing has been claimed for the starboard tack, because some old rules enjoin that the vessel on the starboard tack should *never bear away* but *luff* or *tack* if a collision is imminent; no such rule now exists, and the right of luffing is claimed on the ground that the vessel on port tack under Y.R.A. rules has unconditionally to get out of the way.

The practice of bearing away is a dangerous one, from the fact that, if the vessel on the port tack also bears away, a collision is almost inevitable, and under the aggravated conditions of accelerated speed. Beyond this, in the event of the vessel on the port tack not giving way, there is generally great difficulty in proving the necessity on the part of the vessel on the starboard tack to bear away. Legal decisions could be quoted in which, in the case of collisions, the vessel on the starboard tack has been distinctly blamed for not having luffed, instead of having kept away; but the Board of Trade rule is absolutely silent on the point, and gives no instructions whatever to the vessel on the starboard tack further than by Article 18, which enjoins that when one of two vessels has to keep out of the way, the other shall keep her course; the Y.R.A. rule is equally silent on the point, and it was found inconvenient to stipulate that where one of two vessels has to keep out of the way the other shall keep her course.*

More cases might, and do in fact, occur, when it would be much easier for the vessel on starboard tack to avoid one which has improperly got across her on port tack, by using a little weather helm instead of lee helm; in fact, if the vessel on starboard tack is to strike the other on the starboard quarter (well aft), it is evident that the collision could be better avoided by the vessel on starboard tack bearing away than by luffing. Of course this assumes that the vessel on the port tack has fairly got across the other, and is thus unable to do anything herself to avoid the impending collision. It is quite natural that the masters of square-rigged ships should prefer bearing away to going about, on account of the ease of the one operation in comparison with the labour of the other; but if there is any law (beyond the seaman-like custom of the sea) which condemns them in penalties for the consequences of bearing away instead of tacking, the Board of Trade rule ought clearly to warn them of it. In the merchant navy the general practice is for the vessel on port tack to go about some time before she gets

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*** For instance, the "luffing and bearing away" rule is contrary to the spirit of such a direction as this, and it has been argued that the overtaken vessel should neither be allowed to bear away nor luff to prevent another passing.**

near the other; but in the case of yachts in competitive sailing the vessel on port tack invariably holds on to the last moment, and the vessel on starboard tack, knowing that the other, according to the rule, ought to give way, does the same. And the result is that the question generally amounts to this—What is best to do?—and not what the sailing rule says ought to be done. So far as we know, the rule that the vessel on starboard tack should luff, and not bear away, has never been general; and, although some clubs have gone so far as to say what the vessel on the starboard tack is to do, we cannot call to mind any case where a yacht has been mulcted in a penalty for bearing away instead of luffing. The clubs which had an instruction on the point before their adoption of Y.R.A. Rules were Royal Dart, Royal Victoria, Royal Cornwall, Royal Albert, Royal Welsh, Royal Cinque Ports, and Corinthian; all the others (including Royal Squadron and Royal Thames) were silent, simply requiring the vessel on port tack to keep out of the way of the other. The Royal Victoria rule was the most explicit, and ran as follows: "Yachts on the port tack must give way to those on the starboard tack; and wherever *a doubt exists* of the possibility of weathering the one on the starboard tack, the one on the port tack shall give way; if the other keep her course and collision occurs, the yacht on port tack shall pay all damages and forfeit all claim to the prize. The yacht on the starboard tack shall never bear away; but if she is obliged to luff or tack to avoid the other yacht, the yacht on the port tack (so obliging her to luff or tack) shall lose all claim to the prize."

We believe this rule was framed by the late Mr. G. Holland Ackers, who had a very strong opinion on the point, and published it as a kind of axiom in his Signal Book, &c. The effect of the rule would be, if stringently enforced, that no protest would stand if the vessel on starboard tack kept away instead of luffed. Would this check the dangerous practice of bearing away? We think not. We believe that the greatest safeguard will be in sailing committees and the council of the Y.R.A. firmly administering the very letter of the rule, as it now exists, in all cases wherever a risk of collision has been proved through the vessel on the port tack not giving way. It is much too late to talk about disqualification and penalties after a collision has occurred.

A yacht on the port tack can therefore be disqualified under the following conditions:

1. If she is struck by a yacht which is on the starboard tack, no matter how that striking was brought about.

2. If she herself strikes a yacht which is on the starboard tack.

3. If she causes a yacht which is on the starboard tack to luff or tack to avoid a collision.

4. If she causes a yacht on the starboard tack to bear away to avoid a collision.

We will now say a few words on the conduct of a yacht on the starboard tack. It has already been said that it is the practice to nip or luff the vessel on starboard tack a little when approaching one on the port tack, to show the latter that she must give way. The vessel on the starboard tack should never begin to *bear away* unless she positively intends to go under the stern of the one on the port tack. By bearing away it will encourage the belief on board the vessel on the port tack that she is to pass ahead; then if the vessel on the starboard tack luffs and says she will not allow this, it may be too late for the vessel on the port tack either to bear away or tack and avoid the risk of collision. The safer thing for her to do under such circumstances will be to luff or tack, as this will deaden her way. The vessel on the starboard tack should also luff up, and the two will probably come alongside. A protest will follow, and the vessel on the port tack will excuse herself by saying it would not have happened if the vessel on the starboard tack had not begun to bear away. This may be true, but, inasmuch as it was the duty of the vessel on the port tack to keep clear, no matter what the vessel on the starboard tack might do, the former would be disqualified.

A vessel on port tack approaching another on the opposite tack should never be "nipped" in the hope of weathering. It will not aid her if the other "nips" also, and a collision may be the result. A trusty hand should be placed in the lee quarter to watch the other vessel. Pilots, as a rule, cannot be trusted for this task; they are unused to vessels of such speed, and the latter, so to speak, slip from under their feet, and so their judgment is entirely at fault. If the hand in the lee quarter has the least doubt about weathering, and if you know he can be trusted, put the helm down at once so as to tack well clear of the other vessel, and not have to hustle round under her lee bow and get a tremendous smothering. If it is decided to bear away, begin in good time so that the vessel on the starboard tack may know what you are going to do. Always remember that the whole onus of keeping clear rests with the vessel on the port tack.

As a rule, a sailing master when caught on the port tack will prefer bearing away to tacking, as on the whole less ground is lost, and the vessel does not risk getting a smothering.

In bearing away a hand should be always stationed at the main-sheet (whether it be the vessel on port or starboard tack), to slack out some if necessary, to enable the vessel to get off the wind more rapidly.

OVER-REACHING.

In beating to windward for a mark great care must be taken not to over-reach, that is, not to stand on so long as to be able to more than fetch a mark. In most cases a yacht will fetch a mark on the next tack if the mark is brought to bear abeam—*i.e.*, at right angles to the keel, or eight compass-points from the direction of the vessel's head. This is supposing that there is no tide. If the tide be going to windward, so much need not be allowed; if the tide be going to leeward, more than eight points must be allowed. The helmsman, by watching his vessel and objects on shore or around on previous tacks, will be able to judge how much should be allowed for tide; and he should always remember that it is better to err by allowing too much than too little, providing of course that the vessel does not over-reach so much as to lose her position in the match.

When working by long boards and a vessel tacks for her mark, say a mile off, and can just lie for it, she should be sailed along a good full, and not be nipped or squeezed; if in the end she does not fetch, it cannot be helped, but it is certain that she will not have lost so much ground by having to tack as she would have by sailing out a long board with her sails lifting.

WEATHER BOWING.

A favourite pastime of a sailing master is to "weather bow" another vessel, that is to place his own vessel in such a position on the bow of the other that she immediately intercepts the wind of that other vessel. If the vessels are pretty evenly matched, the leading one will be able to put the other under her lee quarter every time they tack. The one to leeward may ramp off, but she will never get clear unless she is a very much faster vessel. The object of the leeward yacht will be to get into cross tacking, and this her adversary will try to prevent, and tack as frequently as she does. This diversion may possibly be a bad thing for them, so far as the result of the match goes, as their frequent tacking cannot be otherwise than a gain to the vessels that are working by longer boards.

The usual practice to escape the vigilance of the "weather-bowing" craft is to make a feint at tacking, or, as it is sometimes called, to make a "false tack." The master sings out "ready about!" loud enough to be heard perhaps on board the windward yacht, and the crew go to their stations as if about to tack. The master easies the helm down, but is careful that she does not pass the head to wind point; he keeps her shooting, and one hand hauls the foresheet up, and perhaps takes in the slack of the weather jib-sheet. The master of the windward vessel thinks it is a real tack, and puts his vessel about; the other thereupon reverses his helm and backs his vessel's head off on the same tack again. This trick does not always succeed, but it does sometimes.

Frequently a great deal of time is wasted by a sailing master attempting to stop every vessel by "weather bowing" that comes in his way, big or small; this is very foolish. The first aim should be to get all the speed and advantage possible out of a vessel; secondly, if she comes across a vessel that appears to have as good or better a chance of winning than herself, endeavour to stop her by legitimate means, but do not needlessly waste time with a vessel that has little or no chance of winning; thirdly, if you are beating a vessel that, next to yourself, has the best chance of winning by keeping with her, do not leave her; fourthly, if, when sticking to a vessel you are being beaten by her, part company and try your fortune on a different cast.

APPROACHING A MARK ON OPPOSITE TACKS.

It frequently happens that two yachts are approaching a mark on opposite tacks, and the one on the port tack may be able to weather the mark, whilst the one on the starboard tack cannot do so until she goes on the other tack. In Fig. 86 D will be the mark, A a vessel on the starboard tack, and B the one on port tack. It would be the duty of B to give way, even though it were at the finish of a race, and that she was in a position to cross the line E; she would be clearly ahead of A, but might not be able to quite weather her, and so would have to give way. We recollect a case similar to the above happening at Cowes between the Florinda and Arrow; the Arrow was on port tack and gave way, but the late Mr. Chamberlayne said he never gave way more reluctantly in his life; yet, as it was clearly his duty to do so, he ordered the helm of the Arrow to be put down, and the Florinda got round the mark first.

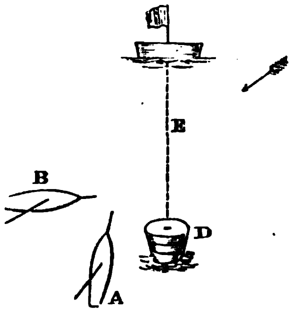

FIG. 86.

The above case is very clear, and there can be no doubt as to what the vessel on the port tack should do; but the case would be more difficult to deal with if the yachts were in the position with regard to the mark shown in Fig. 87. A is a yacht on the starboard tack; B a yacht on the port tack; D a buoy which the yachts have to round and proceed in the direction of the arrow E. B goes into stays under the lee bow, but a little ahead of A, so that when they arrive at the buoy they are in the position of A 2 and B 2, and a collision ensues. B will claim the foul, and argue that A should have given her room at the buoy; A will claim the foul, and say that B should not have gone into stays in a position where A could strike her. B in this case would be in the right, *provided always that the foul would not have occurred if A had not altered her helm by putting it up.* B would not be justified in tacking in such a position if she thereby caused A to put her *helm down or luff* to avoid a collision; nor would she be justified in so tacking if a collision ensued, and A did not alter her course one way or the other. On the other hand, A would not be justified in putting her helm up and so cause a collision or a fouling of the mark.

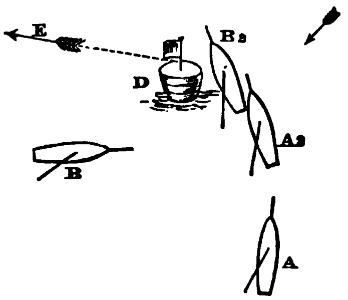

Fig. 87.

ROUNDING MARKS.

By the Y.R.A. rule, yachts must give each other room at marks, but a yacht is not justified in attempting to establish an overlap at the last moment, when it may be impossible for the outside yacht to give room. A yacht in rounding a mark, whether she is hauling round or wearing round, always deadens her way more or less, and if a yacht is close astern so as to be only just clear, it is quite easy for her to make an overlap; but this is just what she is not allowed to do. The overtaking yacht must have, beyond all dispute, established an overlap before the other has altered her helm to round; this means before the other has altered her course and is actually rounding the mark. It frequently happens in light winds that a yacht gets jammed by the tide at a mark, and can only just hold her own abreast of it. A yacht that comes up astern can pass between such other yacht and the mark if there be room; but, if there be not room, she must pass outside.

In running for a mark to haul round, it is generally prudent (if not hauling against a foul tide) to keep to leeward of the mark, and haul up gradually to it, so that by the time the mark is reached all the sheets are flattened in; in fact, the vessel should be almost "brought to" by the mere hauling aft the sheets, and with as little helm as possible. If the yacht has to be "brought to" against the tide, a short sweep should be made in rounding; but the sheets must be got aft smartly, so that when the vessel is actually rounding the mark they are properly trimmed. This is particularly necessary if the yacht has to be brought by the wind, as otherwise, when the helm is put down, she will not come to quickly, and a yacht that may be astern could, by a better hauling of her sheets, come up and cut her out.

If the mark has to be gybed round and the wind is light, the yacht should be run dead for the mark and should gybe close at the mark, always allowing for tide. The boom can be handled easily, and the shorter the circle the vessel can be turned in, the better. But if there is a strong wind, and an attempt is made to make a short turn by wearing close round the mark, it will probably end in disappointment or disaster. Instead of attempting a short turn, the vessel should haul up to windward of her course a little, and gybe over when one hundred yards or so from the mark; there will then be time to trim the sheets properly, and the vessel will not overshoot the mark nor lose any ground. When a vessel is judiciously rounding a mark like this, she may find one ahead that has attempted to make a short turn of it by gybing at the mark, more or less "all standing." This vessel, before she can be met with her helm, will probably fly to; so look and go under her stern, if there is room to do so without striking the mark, and then through her lee. If an attempt is made to keep on her weather, a luffing match will be the result, and perhaps a disastrous collision, as your vessel that gybed first will have great way on, whilst the other will have almost stopped dead. If a collision under such circumstances did occur, the overtaking yacht would be held to blame, as, although it might have been a lubberly thing to have allowed the leading vessel to fly to across the one that was coming up astern, still the latter being the overtaking yacht would have to keep clear. Therefore keep a sharp look-out, and, as before said, if there be room, go under the other vessel's stern, and you certainly will be able to get through her lee. If there be not room to so go under her stern, be ready to give lee helm if necessary to clear her to windward, and you probably will succeed in passing her.

If, when sailing pretty nearly close-hauled, the mark has to be rounded by bearing up, so as to return on a parallel course, the rounding will be an awkward one. If there is much wind it will be prudent to keep well to windward of the mark. Begin to bear up when a hundred yards or so away from it, easing the mainsheet a little, but not touching the head sheets; then as the yacht is nearly close to the mark hard up; as the vessel wears round to nearly before the wind, right the helm and let the boom go over as steadily as possible. Be careful not to ease too much sheet; steady the helm directly it is seen that she has had enough to bring the boom over. The object will be to turn the vessel slowly at first, making a long sweep; then quickly, and then slowly again at the last. In bearing up round a mark in this way care must be taken that neither the boom nor any of the lee rigging touches the markboat; and if the markboat is flying a large flag, be careful not to touch it, as although merely touching the flag would not be held to be a foul, still there would be the risk of the flag getting hung up in some of the yacht's gear, and the boat itself might be dragged alongside.

In gybing always be smart with the topmast shifting backstays and the runners; get them hauled taut before the boom goes over; let go the weather backstay and runner as the boom comes amidships.

As a hauling mark is approached always get the sails well set for coming on the wind. Anything that requires setting up should be attended to before the mark is reached. If a jib requires shifting do not forget that it can be done more easily whilst before the wind than on the wind. Very frequently a vessel is run off the wind on purpose to get in the jib; but this can only be done at a great loss of distance.

Sails will require frequent "setting" during a match, and a sharp look round must be taken constantly, especially when coming to wind from sailing off the wind. In getting a pull on a topsail tack do not forget to ease the sheet first. In setting up the peak of a mainsail always take the weight of the boom with the topping lift. In setting up a jib always see that the runners are taut.

In light weather and with a foul tide, yachts frequently drive back past a mark after fairly rounding it. A case, recently argued, involved the following conditions: In the diagram Fig. 88, A is a buoy which has to be

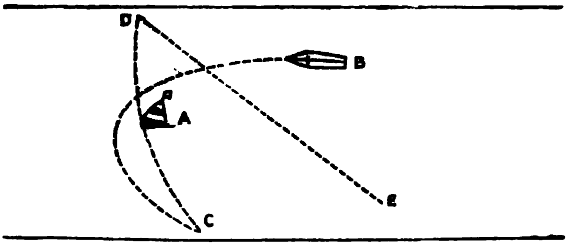

Fig. 88.

rounded on the port hand. B is a yacht running before the wind for the buoy; she hauls round the buoy and stands close hauled to C, where she is fairly above the buoy. The yacht is put about at C, and stands across towards the buoy again, but fails to weather it; she fetches the point D, and stands towards E. It was contended that B not having weathered the buoy in standing from C to D, did not round it on the port hand. But it is quite clear that if the yacht when at C was clear ahead of the buoy A, the rounding would be a good one.

Let it be supposed that the yacht B was beating to the buoy and weathered it, and then ran up past the buoy to E or to a point abreast of C, it could not be contended that the buoy had not been rounded (it always being understood that a mark has not to be "circumnavigated"). If, when the yacht arrived at E or abreast of C, the wind fell light and the tide carried her back past the buoy, and she ultimately repassed the buoy on the side D, that would not affect the first rounding, which would be held to be a good one.

This case can be differently illustrated; at the finish of a race a mark boat had to be left on the starboard hand in the direction of the arrow (Fig. 89). The yacht instead passed up, leaving the mark on her port hand in the direction of the dotted line from A to B; then round the mark until fairly below it at D, where she turned and passed the markboat on her starboard hand, thus fulfilling the conditions.

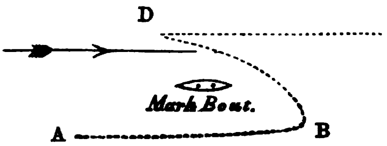

FIG. 89.

In cases like these, the only point to decide is whether the yacht has been in a position to make the rounding a good one. In the first case when at C, it would be required to be proved beyond all doubt that the hull and spars were fairly clear of the buoy in a line at right angles to the last course (the course in the direction of B to A), and unless the yacht were clear of the mark by such a test, the rounding would not be a good one. A similar test would decide the other case by the position at D.

CLOSE-HAULED APPROACHING A SHORE OR MARK.

When two vessels are standing on the same tack for the shore, a shoal, or other obstruction, and the leeward yacht cannot tack without coming in contact with the windward one, she may hail the windward yacht to go about, but she must herself at the same time tack; but if the obstruction is a mark in the course, such as a buoy or vessel, which has to be rounded, the leeward yacht cannot so hail the windward one to go about and give her room to tack. The leeward yacht must ease her helm, and wait till the other one has drawn clear. [This is the Y.R.A. rule.]

When one of two yachts has to tack, the common practice is for the windward one to wait until the other has actually put her helm down before she does so herself; if this is not done, she will probably find that the yacht that was to leeward of her has shot up on her weather quarter—some distance astern perhaps, but still on her weather quarter—instead of under her lee beam or lee quarter. This will be annoying, but naturally it is the thing that the vessel which was to leeward will endeavour to effect; and if previous to tacking her position was under the lee bow of the other, she is certain to effect her object whatever the other might do.

The rule clearly says that the windward vessel shall tack directly she is hailed to do so (providing of course that the vessel to leeward is in actual danger of running aground if she holds on any longer), and that the leeward vessel must at the same time tack; but what the sailing master of the leeward vessel generally does is to gently ease the helm down, and sail his vessel to the last moment, so as to bring her round well on the weather quarter of the other. This is not always achieved, for the reason, as before said, that the windward vessel waits until the other is fairly tacking, or else, in staying, sails round in the same way that the leeward vessel does.

The leeward vessel is the judge of her own peril, but this does not justify her in needlessly putting another vessel about, and in all cases actual peril must exist.

If, when a vessel has just tacked for water, she meets another vessel standing in on starboard tack, she should promptly hail that vessel to go about; but if she herself has gathered way on the port tack, the one on starboard tack can force her round again; and it is no excuse for non-compliance if the vessel on the port tack says, "We have just tacked for water." If she has room to tack again without getting aground, she must do so, and then immediately afterwards can hail the vessel on her weather to tack, if necessary, to enable her to avoid striking the ground.

BEFORE THE WIND UNDER SPINNAKER.

The crew ought to be able to rig and to have all the spinnaker gear ready in five minutes; thus in ordinary weather about that time should be allowed for getting the boom out and spinnaker halyards and outhaul bent, and shifting backstay aft, before bearing up round a mark. If it is to be a dead run, take care that the boom is on the right side, so that the vessel can be run for the next mark without gybing; allow for the tide, if any, scan the wind, and determine which side the spinnaker boom shall be on. If after bearing up it is found that a mistake has been made, and that the vessel will not run for the mark in consequence of the main boom being on the wrong quarter, do not try to make her and get by the lee. When running by the lee the mainsail will be doing but little or no good, and, further, the main boom may come over suddenly and pull down the topmast, or break itself on the runner. Haul up a little, and fill the mainsail; but if it involves hauling up more than a point, and the "run" be a long one, gybe over at once and run straight for the mark.* If the boom has to go square off, ease up the topsail sheet a little, and ease the topsail lacing and tack too, if it strains badly across the peak-halyard blocks. If the peak of the mainsail falls aboard, ease the peak purchase a trifle, but not until the topsail sheet has been eased. Take in the slack of the weather topping lift. Always be careful, if there be much weight in the wind, not to ease the boom off so far as to allow the gaff to press heavily on the lee rigging, as the jaws of the gaff might thereby be broken.

In heavy weather it will not generally be prudent to run with the boom square off, nor to run dead before the wind; keep a little to windward of the course, and then gybe over and run for the mark on the other tack.

With the weight of the boom and spinnaker boom shifted forward the vessel will go down more or less by the head, and if she does not like the trim the crew should walk aft and sit abaft the tiller lines or on the quarter deck.

If the run be a dead one, the helmsman will have two objects in view: 1. To run straight for the mark. 2. To be careful that the mainsail is not gybed.

OVERTAKING YACHTS.

If, when before the wind, a yacht is ahead, and you cannot pass her, run dead in her wake so as to cover her; you may do her a little harm in this way and prevent her getting away farther. If you are overtaking a vessel and desire to pass her, give her a wide berth either to windward or to leeward; to leeward for choice, as if the vessels are dead before the wind your antagonist cannot bear away after you to do any harm; if you try to pass to windward, a senseless luffing match will most likely be the result.

If a vessel is coming up fast astern and threatening your weather quarter, and you make up your mind that she shall not pass to windward, do not wait until her bowsprit is over your quarter before you luff, but take a wipe out across her when she is fifty yards off or so. She will then know what you mean to do, will probably be unable to get on your weather at all, and more probably will not try it. If she bears up to attempt to go through your lee, do not follow her off; if you do, it will probably end, after frequent backing and filling, in her ultimately getting her bowsprit over your weather quarter, and a long luffing match will ensue, followed up perhaps by a protest for bearing away.

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* If the run be 12 miles, and the vessel haul up a point and run, say, on port tack for half the distance, and then gybe over and run on the other tack, she will increase her distance to 12¼ miles.

When one of two yachts which are close together, succeeds in going through the lee of the other yacht, the latter if possible should run dead in the wake of her antagonist that has just passed her. If the wind is very light, she may succeed in holding her. But the yacht that has just passed through the lee of the other should luff out to a clear berth, and she may thus be able to rid herself of the intended covering. If there be an obstruction to sea room she will be unable to luff out clear perhaps, and may very likely try to get clear by running off to leeward; but here she will find that the sternmost yacht can follow her, and generally running off the wind in such a case is of no avail. It must be understood that the prohibition contained in the Y.R.A. rule on "luffing or bearing away" is not involved here, as it is presumed that one yacht has passed clean through the lee of the other, and if she drops back again that other yacht which was passed becomes in the position of an *overtaking yacht*. An *overtaking yacht* is not precluded from bearing away provided she does not cause the yacht overtaken to bear away also to avoid collision; but an *overtaken yacht* is forbidden to bear away to hinder another passing to leeward; that is, a yacht that is *overtaken* by another yacht must concede an unmolested passage to leeward.

SAILING ALONG A WEATHER SHORE—OVERTAKING.

In sailing along a weather shore always remember that, although a yacht may "luff as she pleases to prevent another yacht passing to windward," she may not shove the other yacht ashore or on to any obstruction; on the other hand, a yacht overtaking another yacht should not attempt to make an overlap just upon reaching an obstruction. This means that *the leading yacht can keep her luff up to the very moment that an obstruction is reached, even supposing that an overlap will occur simultaneously with reaching an obstruction. If the overtaking yacht goes ashore or in any way receives or inflicts damages under such circumstances, she is solely responsible.**

In all cases remember that the windward yacht can only demand room in case she would, by holding to her course, actually strike a mark or take the ground.

In sailing along a weather shore, if the yacht drags the ground, promptly ease off the boom and put the helm up, and send all hands forward. The boom is run off to give the vessel greater list, so as to lighten her draught, and also to prevent her coming to and so forge further aground. The object of sending the men forward is, that by tripping the vessel by the head, the draught is lessened. If the vessel drags whilst running along a lee shore, haul the boom in and put the helm down.

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* See the Y.R.A. rule, "Obstructions to Sea Room."

CLOSE-HAULED AND SAILING FREE.

According to Rule 19 of the Y.R.A., a yacht that is sailing with the wind free must keep out of the way of one which is close-hauled, and there appears to be no exception to this rule. In match sailing yachts are likely to get into positions, where one going free might foul one that is close hauled under the following conditions :

1. In beating for a mark when a yacht that is close-hauled might meet one that has already rounded.
2. In running for a mark when the yacht that is before the wind might meet one that has rounded, and is now close-hauled.

In either case it is the duty of the yacht which has the wind free to give way to the yacht that is close-hauled. In most cases it will be safer for the yacht which is free to go under the stern of the other, as by crossing ahead she might compel the yacht that was close-hauled to bear up or luff, and if she did so, the yacht that had the wind free would be disqualified.

MEETING END ON.

In sailing with a beam wind, or if one yacht has the wind abaft the beam and another on the bow, and they be going in opposite directions, they may meet each other end on so as to involve a risk of collision.

In such case it is the duty of each yacht to put her helm to port: that is, the yacht on the port tack will *bear away*, whilst the yacht on the starboard tack will *luff*, and the yacht on the port tack will thus pass on the lee side of the other.

It must be clearly understood that this rule only applies when two yachts are meeting *end on*, so that if no alteration were made in their respective courses a collision would ensue. If the yacht on the port tack has the other, say a couple of points on her lee bow, and they are sailing parallel courses, it would be manifestly absurd for the yachts to port their helms and cross each other, when by continuing their course unaltered they would clear each other.

SAILING FREE.

In sailing free, if two yachts have the wind on the same side, the one which is to windward must keep out of the way of the other. (This has been already explained.)

But it may so happen that the two yachts may be free and be crossing on opposite tacks. Thus, say the wind is W., and one yacht is steering N.N.W., and the other S.S.W., each a point and a half free, they will be approaching each other at an angle of 134°. In such case it will be the duty of the yacht with the wind on the port side to keep clear of the other, as this would be a clear case of crossing on opposite tacks, and not of "meeting end on." This, however, is a situation not likely to occur in match sailing.

SIDE LIGHTS.

In one of the Y.R.A. rules it is enjoined that all yachts sailing in a match at night shall observe the Board of Trade rule as to the carrying of lights. This rule interpreted strictly would mean that the side lights are to be put in their places at sundown. Sailing masters exhibit an extraordinary aversion to exhibiting side lights in a match, for the reason, as they say, that it is not politic for any vessel to let another know what she is doing. This is a reason that will not hold water, and owners should insist upon lights being carried in their proper places. Of course if a match is within a half hour or so of being concluded at sundown, the rule would not be enforced, but where a case of "sailing at night" is involved, it would be inexcusable not to carry lights. It is sometimes supposed that it is sufficient to have the lights on deck ready to show, but obviously if all the yachts in a match did this the lights would be useless, as if the yachts could see each other so as to know when to show their lights, there would be no occasion for exhibiting them at all.

This is one of the rules which owners should see observed as a matter of honour, and no occasion for protest should ever occur under it.

YACHTS IN DIFFERENT MATCHES.

It is now a common practice for two or three or even more matches to be started on the same day to sail over the same course, and the Y.R.A. found it necessary to enjoin that the sailing rules apply to all yachts, whether sailing in the same or in different matches. Frequently a big vessel has unjustifiably bullied a small one round when beating to windward, but under the Y.R.A. rules a small vessel which is on starboard tack can force a large one that might be on port tack to give way. It seems scarcely credible that such a rule should be required, and it is even less credible that it should be occasionally observed with doubtful willingness.

APPENDIX.

DICTIONARY OF GENERAL INFORMATION.

A.

A.B.—Able seaman, who must be able to hand reef and steer, splice, knot, turn in rigging, &c.—able-bodied seaman, as distinguished from a youth or ordinary seaman.

Aback.—A sail is said to be aback when the wind strikes it from ahead and forces a vessel astern; generally applied to square-rigged ships. In a fore-and-aft vessel the sails would be said to be aback if she came up head to wind, and went off on the opposite tack without the sheets being handed over; or if the wind headed the vessel and struck her from the opposite side to that which it had been blowing.

Abaft.—A relative term used to denote the situation of an object or point that is behind another, and begins from the stem head, or from the fore part of any spar or other object; generally the term means towards the stern, or in the direction of the stern.

Abandon.—To leave a ship and take to the boats.

Abeam.—At right angles to a vessel's broadside or keel; opposite to the vessel's centre of length.

Aboard.—Inside a ship or on the deck of a ship. "Come aboard, sir," is a sailor's way of reporting himself on board after leave or absence. To run or fall aboard a vessel is for one vessel to come into collision with another. A sail is said to fall aboard when, from the lightness of the wind or other causes, it ceases to blow out. To haul the boom aboard is to haul the boom in by the mainsheet from off the lee quarter.

About.—To tack. "Ready about" is the signal given for the men to prepare to tack the ship.

About Ship.—The order given to tack, that is to put the vessel on the opposite tack to the one she is on when the order is given. Generally to go on the other tack.

Abreast.—Synonymous with "Abeam." Side by side.

Accommodation.—The cabins of a vessel.

Acker.—A tide coming upon the top of another tide.

Ackers' Scale.—A graduated time allowance computed by the late Mr. G. Holland Ackers, now superseded by the Y.R.A. scale.

A Cock Bill.—An anchor hanging by its ring to the cat head. The situation of yards when one arm is topped up.

Across Tide.—Crossing the stream of the tide so that it comes broadside on. If a vessel in beating to windward crosses a tide fairly at right angles on one tack, she will stem it on the next, or have it stern on, according to whether the tide be lee-going or weather-going. (See "Weather-tide.")

Admeasurement.—An old-fashioned way of expressing the tonnage of a ship calculated by length and breadth.

Admiral.—The highest rank in the Navy. Formerly there were admirals of the red, white, and blue, with the intermediate ranks of vice and rear of the red, white, and blue. When the white ensign was taken exclusively for the Royal Navy about 20 years ago, the red, white, and blue divisions were done away with. Admirals now fly a St. George's Jack, which is a white square flag with red St. George cross in it at the main, fore or mizen, according to their rank.

Admiral of the Fleet.—An honorary distinction bestowed on admirals for long service, &c. If an admiral of the fleet has a command, he hoists the union at the main.

Admiralty Warrants.—Warrants granted to clubs and the members thereof, granting permission to fly the white ensign, or the blue ensign, or the red ensign with device on it. (See "Ensign.") An Admiralty warrant also enables the owner to ship excisable goods, such as wines, spirits, tobacco, tea, &c., direct from bond without payment of duty; and to enter ports without paying harbour dues (this does not include dock charges) and to make fast to mooring buoys laid down by the Admiralty, if such buoys be not required by ships of H.M. fleet. An Admiralty warrant is also useful in foreign ports, as it at once establishes the nationality of a yacht; and the port authorities usually show great civility to yachts carrying an Admiralty warrant, securely berthing them and frequently foregoing harbour dues (not dock charges). When a yacht changes hands her warrant must be returned through the club secretary to the Admiralty. (See "Ensign.")

Adrift.—Floating with the tide. Generally driving about without control. Also a vessel is said to be adrift when she breaks away from her moorings, warps, &c.

Afloat.—The state of being waterborne after being aground. To be on board ship.

Afore.—The contrary of abaft. Towards the forward end of anything.

Aft.—An abbreviation of abaft, generally applied to the stern. To go aft is to walk towards the stern; to launch aft is to move a spar or anything else towards the stern. To haul aft the sheets is to bring the clew of the sail more aboard by hauling on the sheets.

After.—The state of being aft, as after-sail, after-side, &c.

After Body.—The part of a vessel abaft her midship section.

After End.—The stern end of a vessel or anything else.

After Guard.—Men stationed aft to work sheets, &c. In yachts, if there be any amateurs on board, they are generally made use of as an after guard. In merchant ships the ordinary seamen or landsmen enjoy the distinction.

After-most.—A thing or point situated the most aft of all.

Afternoon Watch.—The watch between noon and four o'clock.

After Part.—The stern extremities of a vessel or anything else.

After Peak.—The hold of a vessel near the run. A small cuddy or locker made in the run of a small boat aft.

After Rake.—Contrary to fore rake. The rake or overhang the stern-post has abaft the heel of the keel. To incline sternwards.

Aftward.—Towards the stern; contrary to forward.

Against the Sun.—An expression used to show how a rope is coiled: from right to left is against the sun, from left to right is with the sun. The wind is said to blow against the sun when it comes from the westward.

Agreement.—The document executed, when a vessel is built, by the builder and the person for whom the vessel is being built. The following is a form of agreement recently used:

An Agreement between Messrs. , of , yacht builders, hereinafter called the builder, of the one part, and , of , Esquire, hereinafter called the owner, of the other part.

The builders shall build and equip a yacht according to the specification and drawings marked A, B, C, and signed by the parties hereto. The yacht shall be built and completed in all particulars according to the requirements of the said specification, and the whole of the workmanship and material shall be such as shall be required by Lloyd's Rules, and such as will entitle the yacht to be classed at Lloyd's as a yacht 15 A 1. The whole of the work shall be executed under the special survey of Lloyd's surveyor, and to the satisfaction of Lloyd's committee; and also to the satisfaction of , marine architect, hereafter called the architect. The yacht shall be delivered to the owner complete as aforesaid, safely moored in . In consideration of these premises, the builder shall be entitled to be paid by the owner as follows:— pounds on the signing of this agreement; a further sum of pounds when the said yacht shall be in frame, and the architect shall have given a certificate in writing under his hand that the yacht is in frame, and all the work up to that stage has been done to the satisfaction of Lloyd's surveyor and to the satisfaction of the architect; a further sum of pounds when the yacht shall be completely timbered and planked, and the deck laid, the coamings fixed, and the architect shall have given a certificate in writing under his hand that the yacht is completely timbered and planked, and the deck laid, and the coamings fixed, and that all the work up to that stage has been done to the satisfaction of Lloyd's surveyor and to the satisfaction of the architect.

When the vessel shall have been duly launched and classed at Lloyd's 15 A 1, and when the said architect shall have given a certificate under his hand that the vessel has been completed in all respects to his satisfaction, according to the said plans and specification, and the vessel has been delivered afloat, and complete in all respects for sea, and moored in safety in , the owner shall, pay to the builder the further sum of pounds.

The yacht from and after the payment of the said sum of pounds, to be paid on the signing of this agreement, shall be and continue to be, the property of the owner; and all the materials intended for, or appropriated to the said yacht, shall be deemed to be the property of the owner.

If at any time the builder shall become bankrupt, or enter into any arrangement with his creditors under the Bankruptcy Acts, or shall fail or be unable to complete the said vessel in accordance with this agreement, or shall in the opinion of the architect be guilty of any unreasonable delay in the execution of the work agreed to be done, then it shall be lawful for the owner to enter upon the builder's yard and take possession of the said yacht, and to cause the work included in this agreement to be completed by any person or persons whom he shall see fit. All damage that shall happen to the said yacht agreed to be built as aforesaid, or to the materials intended to be used in her construction, by fire or otherwise, previous to her being delivered to the owner complete as aforesaid, shall be forthwith made good by and at the expense of the builder.

The architect and the owner shall at all times be permitted to have access to the said yacht during the progress of the works.

The builder shall deliver the said yacht complete for sea, according to the said plans and specification, afloat at , and classed at Lloyd's as aforesaid, on or before the first day of , one thousand eight hundred and seventy-eight, and in default he shall pay for each and every day after the said first day of during which the said yacht remains undelivered or unclassed as aforesaid, the sum of pounds a day as and for liquidated damages; and the said sum of pounds a day may be deducted by the owner from any money payable, or to become payable, by him to the builder.

The builder shall not be entitled to make any claim or demand upon the owner for work done upon the said yacht, or in connection with the building or equipment thereof, or for any alterations or extras beyond the remuneration hereinbefore mentioned, except in respect of work for which written certificates, describing the work as extra work, shall be given under the hand of the architect and countersigned by the owner.

No work done on the said yacht without a written order signed by the architect, and counter-signed by the owner, shall be deemed to be extra work. The builder shall not be entitled to an extension of the said time by reason of any extra work or alteration being ordered unless a written order for such extra work be signed by the architect and countersigned by the owner, and unless the architect shall think fit at the time such written order is given by written certificate under his hand to extend the time fixed for completion, and then the time shall be extended only so far as the architect by the said certificate shall determine.

Any dispute arising between the builder and the owner respecting anything contained in this agreement, or in the specification and plans above referred to, or in any way relating to the building, equipping, or delivery of the yacht shall be referred to the said architect, whose decision shall be final, or, him failing, to some other arbitrator to be agreed upon between the parties, or to be nominated, in case of difference, by the registrar of the Admiralty Division. The costs of any such reference to be in the discretion of the arbitrator. This agreement may be made a rule of the High Court of Justice if the court shall so think fit.

Specification.—*Design and Dimensions*: The yacht to be built according to drawings and plans furnished by and to be of the following dimensions:—The length on deck from the fore side of the stem to the aft side of the stern post, to be 50ft.; and the length between perpendiculars, measured along the rabbet of the keel from the after side of the stern post, to a perpendicular dropped from the fore side of the stem at the deck to be 46ft.; and the breadth, from outside to outside of the planking in the broadest part of the yacht, to be 11ft.; and the least height of freeboard to be 2ft. 7in., the dimensions shown in the drawings. *Keel*: The keel to be of sound English or American elm, 8in. sided, and not less than 8in. deep, to taper fore and aft to stem and stern post. If the keel be in two pieces, the scarph to be not less than 6ft. long, butted and bolted with ¾in. metal bolts, six in number. A solid iron keel to be cast and fitted underneath the main keel amidships, as shown in plan, 26ft. in length; the builder to make the moulds for and find the iron. *Stem*: To be a sound piece of English oak, with a grown crook, 5in., sided and 14in. moulded, properly butted and scarphed into keel, and bolted with ¾in. copper bolts. *Stern Post*: The stern post to be of English oak, 7in., sided at top, and 9in. moulded. *Knightheads and Apron*: The knightheads and apron to be of English oak. *Deadwoods*: The upper deadwoods of English oak, and of sufficient depth to receive the timbers, and to be bolted with ¾in. metal bolts. *Futtocks and Timbers*: The futtocks and timbers to be of English oak, with room and space centre to centre of 18in., and to be 4in. sided and 4in. moulded, each to be step-butted and spiked to the keel deadwoods or hogging piece. The heels of first futtocks can meet on the top middle line of the keel. In either case they must be securely fastened to keel with wrought iron knee floors, through-bolted to keel and futtocks with ⅝in. metal bolts. Iron floor plates 7/16in. thick, to be fitted to sufficiently connect the heels of the frames. The double timbers to be bolted together with ½in. iron, galvanised, and the heels and heads to fit closely and neatly. *Garboards*: The garboard strakes to be of sound American rock elm, not less than 9in. wide and 2in. thick. *Planking*: Six strakes below the water line to be of English oak, the sheerstrake and six topside strakes of teak, and the remainder of the plank to be of pitch pine, the whole to be wrought in parallel strakes 2in. thick, and not more than 5in. deep (the sheerstrake te be 7in. wide), and in long lengths, the butts to have not less than 5ft. shift, to have a ½in. copper bolt clinched through every third timber, and to have a cast metal 4½in. dump in the remaining timbers. The butts of the planks to be well fitted and caulked, and each butt to have ½in. wrought copper bolt through the centre of the plank, and the timber next thereto, all fastenings to be punched home ¼in. deep to receive putty stops. *Shelf*: The shelf to be of English oak, 5in. thick by 6in. deep, as shown in the drawing C, shewing the midship section, through-fastened to top and second strake with ½in. metal bolts at every timber, and to have a strong galvanised iron breast-hook forward, and galvanised iron knees aft. Beams to be dovetailed to the shelf, and well bolted with metal bolts. The clamp to be 3in. thick. *Bilge Strake*: The two bilge strakes to be of English oak 6in. by 2in., running fore and aft on each side, and to be through fastened with ½in. copper bolts, and to have a galvanised iron breast hook forward, and to be bolted into transom with metal bolts aft. *Deck beams*: The deck beams to be of English oak, 4in. sided and 4in. moulded, and to have about 4in. rise at centre; to have galvanised iron knees where required, carefully fitted and bolted through the top timbers and top strake with ½in. metal bolts; the bitt and mast beams, and the other beams, to have a galvanised iron hanging knee at each end, with three ½in. metal bolts through each arm. English oak lodging knees to be fitted between the beams in wake of the mast, and where required. *Covering Board*: The covering board to be of teak, 7½in. wide and 2in. thick, properly secured to top strake and clamp, and to project about ¾in. outside of the plank. *Deck Plank*: The deck plank to be of picked, well-seasoned Quebec yellow pine, free from knots and defects, in long lengths, tapered as required; no feather edges to be left at endings of planks, forward or aft, the ends to butt ¾in. into covering board; the plank to be 2in. thick, and to be dowelled and nailed diagonally, with yellow metal nails at the sides, so that no nail heads show. *Bulwarks*: The bulwark stanchions to be of oak, 3in. moulded and 3½in. sided at deck. The bulwark skirting to be of teak. *Rail*: The top rail to be of American elm, 3½in. by 2in., free of defects, and fitted fair. *Rudder*: The main piece of rudder to be of one solid piece of English oak, and to have a carefully fitted water-tight rudder trunk; to have strong copper braces, fitted with a rule joint, let in flush with stern post; also a strong brass or gun metal bearing at heel, to have an iron strap round the rudder head, and the rudder head to fit, and work in a metal collar, sunk into the deck with chock of teak; to have a neat brass cap, with name of yacht, if required, engraved thereon, to have two neat carved oak or mahogany tillers, with brass fittings. *Caulking*: The outside planking to be thoroughly and carefully caulked, and the seams carefully payed and puttied, and the deck to be very neatly and carefully caulked and payed with marine glue, the whole of the seams of hull and deck planking to be made tight; the outside planking to be painted with three coats of paint; two coats of composition to be laid on the bottom, and at the end of the season, or when required by the owner, the hull to be sheathed with copper sheets carefully laid on, 18oz. below the water line and 20oz. at and above the water-line. *Ballast*: The builder to supply and carefully stow a sufficient quantity of pig iron ballast (besides iron keel) to put the yacht to the designed load-line; the ballast to be painted with one coat of red lead paint. The builder to supply lead ballast if so required by the owner, allowing for the difference between the prices of pig iron ballast and lead. *Bitts*: The bowsprit bitts to be of sound English oak fitted and fastened in the usual way, mast bitts of English oak to be fitted on the fore-side and aft-side of mast, with usual cross pieces and all other necessary belaying bitts, pin racks, cleats, cavels, loading sheaves, eye bolts, and other usual deck fittings to be found and fitted as required. *Pump*: A properly-constructed lead pump to be fitted, 4in. in diameter, with lead tail pipe, and rose at bottom, and the discharge pipe to lead under the gunwale. *Water-closet*: To have a patent water-closet of the most approved construction with mahogany seat and fittings complete. *Deck Fittings*: All the usual hawse pipes and chain pipes to be properly and carefully fitted; channels and chain plates, bolts, and dead eyes as required; bowsprit gammon iron at stem to be covered with leather. *Bobstay Shackle and Rod*: To have strong bobstay shackle cast in copper to fit the stem, and to let in flush with the wood so far as may be prudent, and rivetted through, the bobstay chain to be of galvanised iron, and fitted to bobstay shackle. *Davits*: To have boat's davits fitted to ship on one side, also one small anchor davit to ship on either bow. *Ridge Rope Stanchions*: To have six brass stanchions for ridge ropes on either side of the same, to be hand-burnished in the best manner and fitted into square sockets in rail and lower part of bulwarks stanchions. *Iron Cleats*: To have two well-furnished cleats on taffrail, and two galvanised iron cleats on bow, and to have, if required, a neat elm grating extending from taffrail to mizen mast. To have iron roller in sheave fitted for hawse pipe to take chain cable. *Hatches*: The companion to be of teak fitted with brass slides as required, and to shut in with shifting panel or doors at after side, and secured with brass hasp and padlock. The fore hatch to be of teak, to be very carefully fitted as required by owner. The sail room hatch to be of teak of convenient diameter, to be securely fitted with coamings on deck, and fastened with brass lock on the aft side, and brass hasp and padlock on the fore side. *Skylights*: The main cabin and other skylights to be of teak, fitted on teak coamings, and made to ship and unship in the usual way, and to have proper brass fastenings inside, and to be thoroughly water-tight in every way, and the glass panes to be protected by neat brass guards, or by galvanised iron or teak bars, as required by the owners. A curtain sliding on brass rods to be fitted to the skylight in the main. After-cabin skylight coatings to be provided. *Companion Ladder*: The companion ladder to be fitted as required, with glass windows, if required, at back of ladder, opening into after cabin. *Ceiling*: The yacht to be ceiled throughout, down to the ballast line, with 1½in. pitch pine, carefully planned and fitted on the timbers; below ballast line to be coated with red lead, gas tar, or varnish. *Platform*: The platform and platform beams to be of fir, and laid as required; the floor to be secured to beams with brass screws. The floor at the foot of companion to be formed of a neat American elm grating, carefully fitted. *Main Cabin*: The main cabin to be fitted according to the plans supplied by owner, with hard wood panelled bulkheads, doors, sofas or bed berths, with lee boards. The cabin to be fitted with polished pitch pine panels, and mahogany styles. One mahogany cupboard or sideboard to be fitted at the after end or both ends of each sofa, and a mahogany shelf with small open rail extending the whole length of the cabin to be fitted above each sofa. A small mahogany bookcase to be fitted against one of the bulkheads. All locks, bolts, hinges, hasps, or other fastenings, and all keys in the main cabin, and in every other part of the vessel to be made of brass. *Stove*: An approved stove to be fitted in forward bulkhead of the main cabin, with fender and irons complete; brass screw coamings for funnel, and length of copper chimney to lead clear of rail. *Forecastle*: The forecastle to be bulkheaded, as required, and fitted with lockers, shelves, cupboards, locks, door, rack, table, seats with lockers underneath, and to have the usual lockers, and the lockers for chain and coke, closely ceiled to prevent dirt or dust from the same getting into the hold; also similar lockers to be fitted below the pantry, and fore state room floor. To have a neat iron ladder from floor to deck, fitted to ship and unship; a portable commode to be fitted, if required, in the forecastle, and one in after cabin. *Sheet Lead Coverings*: The floor underneath the cooking stove, and all the wood work near the stove, to be neatly covered with sheet lead, nailed with copper tacks. *Water Tank*: A properly constructed galvanised iron water tank, with manhole, to be provided, and fitted below the floor with pump and supply pipe attached, with brass deck plate, and screw cover for the same. *Cooking Stove*: A patent cooking apparatus (No. 3), of Atkey's make, to be fitted complete with Atkey's patent ventilation coamings; length of copper piping to funnel sufficient to lead clear of rail. *Hammocks*: Three hammocks, with bedding complete, to be fitted. *Mops, Brooms, &c.*: All the usual mops, brooms, brushes, buckets, squeegee, and other forecastle articles to be supplied. *Pantry*: The pantry to be fitted up as required, with dresser, shelves, liquor holes, racks, hooks, drawers, lockers, &c., and mahogany door opening into main cabin. *Fore State Room*: The fore state room to be fitted with bed berth of mahogany, with drawers underneath, mahogany washstand, and a folding mahogany slab to form a writing table; cupboard, underneath shelves, racks, &c., mahogany door, &c. The space on port side of companion way to be fitted with seats or lockers, as required. *Ladies' Cabin*: The ladies' cabin to be fitted with polished wood panels, same as main cabin, with mahogany bed berths and washstands, cupboards and drawers, as required, and the sofas to be fitted with lockers underneath, and the doors to be fitted as required. *Lavatory*: The lavatory to be fitted with patent washstand, with tap and water; a tank for water supply, and a patent water closet of the best construction, to be fitted with mahogany seat, the lavatory to be bulkheaded or doored, as required. *Spars*: To be supplied with a complete set of spars, as required for a yawl of twenty-five tons, the whole to be carefully made, and all the ironwork to be of the finest quality, and galvanised, the dimensions of the spars to be according to plans supplied by the owner. *Mainmast*: The mainmast to be a picked spar, as free from knots as may be, of Oregon or Baltic red pine, fitted complete in every respect as required. *Mast Step*: The mast to be stepped into a solid iron mast step to be furnished by the builder. *Hoops*: The usual mast hoops properly riveted to be fitted to mast. *Crosstrees*: The crosstrees to be carefully fitted as required. *Bowsprit*: The bowsprit to have a galvanised iron rack plate on the upper side from the heel to the stem, and a stout galvanised iron pinion where fitted to the bitts, with handle for the same, and a lignum vitæ roller between the bitts with a score round the centre to allow for the passage of the rack plate; also a plain stout lignum vitæ roller between the bitts on the under side of the heel of the bowsprit. A small, square, iron fid as required, sheave at outer end, traveller leather covered. *Whiskers*: Galvanised iron whiskers, fitted with preventer rods and all the other usual fittings for the bowsprit as required, to be carefully fitted. *Main-boom*: The main-boom to be fitted to mast with iron band and universal joint, and all other fittings, including reef cleats, to be neatly fitted as required. *Gaff*: The gaff to be fitted with strong iron jaws, and the other fittings as required. *Trysail Gaff*: The trysail gaff to be similarly fitted so that the jaws may be used with either gaff. *Topmast*: The topmast to be fitted with galvanised iron self-acting fid and a brass-bound sheave in heel for mast rope; all the other fittings to be carefully made as required. *Topsail Yard*: The topsail yard to be supplied of such dimensions as may be required. *Squaresail Yard and Boom*: A squaresail yard and boom to be fitted in the usual way as required. *Mizen-mast*: The mizen-mast, boom, boomkin, yard, &c., to be fitted as required, and the mast to be stepped securely. *Rigging and Blocks*: The standing and running rigging of wire, hemp, and manilla of suitable sizes, to be most carefully fitted, and the patent blocks for the same to be all of the best make, the whole standing and running rigging, blocks, tackles, &c., to be fitted complete in every detail. The main and gaff halyards to be of the best Russian hemp, the jib halyards of chain. *Sails*: A complete suit of sails fit for a yawl of 25 tons, to be found by the builder, and made by Lapthorn, and to consist of mainsail, two mizens, foresail, four jibs, two topsails, squaresail, trysail, and a complete set of sail covers, properly painted, to be supplied, and bags for the smaller sails. *Anchors*: One Trottman anchor of 1¼cwt., one Wastrey Smith's anchor of 1¼cwt., and one kedge anchor, to be supplied. *Chain Cable*: Ninety fathoms of 9-16 chain cable, galvanised, to be supplied. *Hawsers*: Two hawsers of 60 fathoms each, suitable for the yacht, to be supplied. *Windlass*: An improved ratchet windlass with double lever to be fitted. *Painting*: The outside of the vessel to be made as smooth as possible, and to have the usual number of coats of the best oil paint. A gilt strake. *Varnish*: Bulwarks and all woodwork fittings on deck to have three coats of the best varnish. *Inside Paint*: The underside of the deck, and such other parts of the vessel as may require it, to have three coats of the best zinc white. *Upholstery*: The upholstery work to be complete, and to consist of Brussels carpet for the main cabin, ladies' cabin, and state room, hard-seasoned oilcloth for the lavatory. *Sofas*: The sofa mattresses, backs, and pillows to be of hair, and covered with rep, Utrecht velvet, or leather, as required. *Cabin Tables, Chairs, &c.*: A mahogany swing table to be fitted in main cabin, with cloth cover complete, also three folding chairs, Atkey's Osborne swing lamp, and the stove before mentioned. *State Room Beds*: The berths in the state room and ladies' cabin to be fitted with hair mattresses, down feather bolsters and pillows of the best quality, and three blankets of the finest quality to be supplied for each bed. *Toilet China*: The usual toilet china to be supplied to each berth, but to be selected by owner. *Lamps*: A suitable bronze swing lamp to be supplied to each berth. *State-room Sofas*: The sofas or seats in the after state-room or ladies' cabin to be fitted with hair mattresses covered in rep or Utrecht velvet. *Boats*: A suitable gig, to be supplied with oars, brass rowlocks, and yoke, mahogany back board, and elm grating, and boat hooks complete in every respect; also a dinghey, with brass rowlocks and oars. *Binnacle*: A binnacle of teak, with brass lamp and fittings, suitable for one of Sir William Thompson's patent compasses, to be supplied by builder. The compass to be supplied by owner, the builder to allow the difference between the cost of the patent compass and an ordinary compass. *Winch*: A lever ratchet winch to be fitted on the main mast. *Side Lamps, &c.*: Side lamps (diopteric) to be supplied, together with screens and galvanised iron stanchions, made to fit into the rail or into fastenings fixed on the rail. The lower part of the stanchions to be made to fit into the covering board, or into fastenings on the lower part of the bulwark stanchions. The side light screens to be made with brass hinges, so as to fold flat when out of use. An anchor lamp (diopteric) to be supplied. A rack to be fitted in the forecastle to receive the screens and lamps. *Lead Line*: A hand lead and properly marked line to be supplied. *Bell*: A ship's bell of the size required by the Board of Trade to be supplied, and to be fitted on deck if required. *Legs*: Galvanised iron legs to be provided, with fittings complete. *Finally*: The whole of the workmanship and materials to be of the very best quality, and, notwithstanding any omission from this specification, the builder is at his own expense to complete the vessel in every detail, in what is understood as hull, masts, spars, ironwork, and deck and cabin fittings as usual in first-class yachts, with all joiner's, cabinet maker's, painter's, and plumber's, and upholsterer's work appertaining thereto.

Aground.—A vessel is said to be aground when her keel or bottom rests on the ground.

Ahead.—Forward; in advance of.

Ahoy.—An interjection used to attract attention in hailing a vessel, as "Galatea Ahoy!"

A-Hull.—A ship under bare poles with her helm lashed a-lee. An abandoned ship.

Air-Tight Cases for Small Boats.—By air-tight cases is meant cases that will keep out water. The most general form of case is made of zinc, copper, or Muntz metal. Macintosh bags have been used; and are put inside wood lockers and then inflated, the object of inflation being of course to keep the bags from collapsing, thus practically making the wood lockers impervious to the influx of water. As any kind of bag is liable to be punctured or otherwise damaged, metal cases are to be preferred—they should be fitted inside wood lockers. To render a boat unsubmergeable she must be provided with cases which will displace a quantity of water equal to the weight of the boat. A ton of salt water is equal to 35 cubic feet of the same: now suppose a boat 16ft. long and 6ft. broad weighed 15cwt. (¾ton) with all passengers, gear, air-tight cases, &c., on board, then she would require air-tight cases equal in bulk to 26¼ cubic feet, as there are 26¼ cubic feet of water to ¾ton weight. But it may be taken that the wood material used in the construction of the boat, the spars, and wood cases, would be self-supporting. Say that these weighed 5cwt., then 10cwt. (½ton) would remain to be supported, ½ a ton is equal to 17½ cubic feet. A locker 6ft. long, 2ft. broad, and 1ft. 6in. deep would contain 18 cubic feet, and so would support the boat with her passengers on board, or prevent her sinking if filled to the gunwale with water. Of course it would be rather awkward to have such a large locker as this in so small a boat, and the air-tight spaces are usually contrived by having a number of lockers, some under the thwarts, in the bow end and stern end of the boat, and sometimes above the thwarts under the gunwales.

Some boats are made unsubmergeable by a cork belting fixed outside below the gunwale. One ton of cork is equal to 150 cubic feet of the same, and will support 3¼tons in water. Thus, roughly, cork will support three times its own weight in water. Supposing it is sought to support a boat equal to 10cwt. as stated above; then a belting of cork will have to be used equal to 17½ cubic feet, plus a quantity equal to the weight of the bulk of the cork. Say the boat is 16ft. long, and the measurement round the gunwales will be 32ft. A tube 32ft. long to contain 17½ cubic feet would require to be 10¼ inches in diameter. [The contents of a tube are found by multiplying its length by the area of one end. This area is found by taking the square of the diameter and multiplying it by ·78 (see "Areas of Circles).] The 17½ cubic feet of cork would weigh (17·5×15) 262½lb. equal to 4 cubic feet of salt water, and so an addition would have to be made to the tubing to that extent. Thus in round numbers 22 cubic feet of cork would be required to support 10 cwt. net. A tube 32ft. long and 11in. in diameter would contain 22·0 cubic feet. The tubes that contain the cork are usually made of canvas and painted. The weight of the canvas tube would have to be added to the general weight to be supported. Solid cork should be used, and not cork shavings, for filling the tubes; cork shavings get more or less saturated and lose their buoyancy, and generally have less buoyancy than solid cork, in consequence of the multitude of spaces between the shavings which would admit water.

The accompanying sketch shows a small boat with a cork belting round under her gunwales.

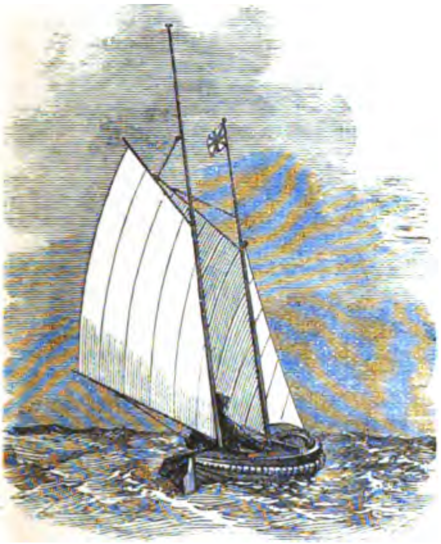


Fig. 90.

A-Lee.—To leeward. The helm is a-lee when it is put down to leeward. Hard a-lee means that the helm must be put as far to leeward as it can be got.

All.—A prefix put to many words to show that the whole is included, as "all aback," meaning all the sails are aback; "all-a-taunto," meaning that the ship is fully rigged and fitted out, with everything in its place; "all hands," the whole ship's company; "all standing," with everything in its place—nothing being shifted, &c.

All Aback Forward.—A cry raised when a vessel is sailed so near to wind that the head sails lift or shake.

Aloft.—Up the mast; overhead. "Aloft there!" is a manner of hailing seamen who may be aloft on the mast tops, yards, &c.

Along.—Sailing along the wind means to sail with the wind from a point to four points free. To lay along the land is when a vessel can hug or keep close to the land without tacking.

Along Shore.—Close to the shore, by the shore, or on the shore.

Alongside.—By the side of the ship. "The gig is alongside, sir," is a common way of informing the owner, master, or other officers that the boat is manned and by the gangway, in readiness to take people off; also said when a boat is brought to the gangway so that the passengers can embark.

Amidships.—The middle part of a ship. The middle part of anything. To put the helm amidships is to bring it in a line with the keel. Generally the word has reference to the middle fore-and-aft line of the ship, and not to a middle athwartship part of a ship,

Anchor for Small Boats.—For small open boats the anchor should weigh 1lb. for every foot of length up to 20ft. length; but if the boat be ballasted another ½lb. per foot of length should be added.

Anchor Shackle.—A shackle which connects the chain with the anchor.

Anchor, Tripping an.—If an anchor is let go on very firm holding-ground, or on ground where the anchor is likely to get foul, a tripping line is made fast to the crown of the anchor; to the other end of the line a buoy is made fast, and when the anchor is "wanted" it can be broken out of the ground by hauling on the tripping line if it cannot be got by hauling on the cable.

Another plan is to "scow" the anchor by bending the end of the cable to the crown instead of to the ring. The cable is then "stopped" to the ring by a yarn. When the cable is hauled upon the stop breaks, and of course the cable being fast to the crown the anchor is readily broken out of the ground. A boat should not be left moored with her anchor "scowed," as, if any unusual strain came upon the cable, the stop would break and the boat would probably go adrift. The trip line should be used in such cases. (See "Scowing.")

Anchor Watch.—A watch kept constantly on deck when a ship is at anchor, to be ready to veer out or take in chain, or to slip, make sail, &c., if the vessel be in danger of collision or other mishaps. One hand may keep an anchor watch, and call up the officers and crew if necessary.

Anchor, Winch for Raising a Boat's.—Very neat and small winches are now made for almost any sized boat that has a deck forward, but a winch is not readily fitted to an open boat, and fishermen have a very simple contrivance to obtain the necessary power. Get a short piece of hard wood about 4in. in diameter, and of a length equal to the width of the boat at the gunwale, where it is to be fitted to serve as the barrel of a winch (termed a "wink" by the fishermen). In either end drive an iron pin to form an axle, and to keep the wood from opening fit an iron band on either end (all the iron should be galvanised). On each gunwale fit an iron plate—a round hole in one plate and a hole and slot (opening aft) in the other. A hole must be bored through the wood to receive a short bar of tough wood or iron three or four feet long, to serve as a lever, or three or four pegs can be inserted, as is shown in the sketch. The end of the cable will be fast to the wink, and as the latter is hove round the cable will be wound up. If there be two hands in the boat the cable need not be fast to the wink, but one hand can heave whilst the other holds on to the cable and coils away. A ratchet and pawl are sometimes fitted to the wink.

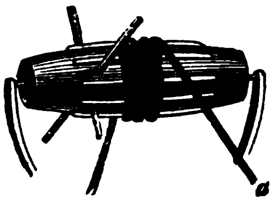


FIG. 91.

Anchors (*Cole's*).—This is an anchor something like the old "bay." It has a very long shank and sharp clean flukes. The crown is fitted to the shank and kept in its place by a pin. The advantage of this anchor is its great holding power and the quickness with which it gets a hold even in hard ground. In letting go very little chain is required to bring a vessel up, but if the vessel has much way on a good scope should be given, as the anchor is a dangerous one to snub. The parts of the anchor are very light, and generally the weight required is 25 per cent. less than the weight of other anchors.

Answer.—To repeat an order after an officer; thus, if the order be to the helmsman, "No more away," he will repeat, "No more away, sir;" or to the jib-sheetman, "Check the jib-sheet," he will answer, "Check the jib-sheet, sir." Thus the crew should always "answer" every order to show that they comprehend.

Answer Her Helm.—A vessel is said to answer her helm when she moves quickly in obedience to a movement of the rudder. Long deep vessels are slow to answer their helm (see page 27).

A 1.—The highest class obtainable at Lloyd's. Formerly (from about 1760) all new ships were classed A with a term of years according to their port of building; after this term expired the ship was degraded to the E or I class, and so frequently it happened that a bad ship got a long term and a good one a short term; and perhaps the short termed ship when repaired for the class E was better than the long termed one was when first built. Such an absurd way of classing formed no useful guide for underwriters or insurance brokers, and in 1824 the present well-known committee of "Lloyd's Register" was established, by which ships are classed and given a term, according as they are built, in compliance with certain rules. A 1 is the highest class. A denotes that the hull is built of good materials, in accordance with certain rules. 1 is the symbol that the rigging and general equipment of the ship are in every way perfect. The number of years assigned to a ship as her term depends upon the quality of the materials used and the mode of construction, and may vary from eight to seventeen years. A well built ship upon being restored may be retained in the A class. "A in red" are ships that have passed their term, or ships that were not classed when built. Class Æ applies to ships fit only for short voyages. Class E and I are similar to Æ, but denote that the ships are not fit to carry perishable goods on any voyage. It is seldom that any number is assigned but 1, and generally the classes will be found distinguished by A 1 15 years, A 1 (in red) 7 years, Æ 1; the classes Æ, E and I are subject to annual inspection (see Lloyd's Yacht Register).

A-Peek or Peak.—An anchor is said to be a-peak when the cable has been so much hove in as to form a line with the forestay; "hove short" so that the vessel is over her anchor. Yards are a-peak when topped by opposite lifts.

Apostles.—Seaman's slang for knightheads, bollards, &c., for belaying warps to.

Apron.—A piece of timber fitted at the fore end of the keel at its intersection with the stem.

Arch Board.—The formation of the counter at its extreme aft end, being a continuation of the plank sheer, and covers the heads of the counter frames.

Ardent.—A vessel is said to be ardent when she gripes or shows a tendency to come to against a weather helm.

Areas of Circles.—The area of a circle is found by multiplying the square of the diameter by the fraction 0·7854. The areas of small circles in decimals of a foot are given in the following table.

Diameter in inches.	Equivalent diameter in decimals of a linear foot of 12 inches.	Area of circle in decimals of a square foot.	Circumference of the circle in inches.
1⅕	0·1	0·0078	3·92
2⅖	0·2	0·0314	7·46
3⅗	0·3	0·0706	11·38
4⅘	0·4	0·1256	14·92
6	0·5	0·1963	18·84
7⅕	0·6	0·2827	22·27
8⅖	0·7	0·3848	26·31
9⅗	0·8	0·5026	30·23
10⅘	0·9	0·6362	33·77
12	1·0	0·7840	37·69

The contents of a tube or cylinder can be found by the above table.

Thus, say a tube 30ft. long be 3⅗in. (equal to 0·3 of a foot) in diameter, then the area of one end of the tube will be ·0706 sq. ft. The contents of the tube will be found by multiplying its length by the fraction ·0706 (30 × ·0706 2·118 cubic feet). If the tube were 6in. in diameter, then its contents would be 30 × ·5 = 15 cubic feet.

Arms.—The extremities of anything, as yard arms.

Ashore.—A vessel is said to be ashore when she is aground. To go ashore is to leave the ship for the land.

A-stay.—Synonymous with a-peak.

Astbury's Tanning for Sails.—This is a composition for tanning sails without altering their colour: it is said to preserve the canvas and render it waterproof. Messrs. Astbury's address is 48, King-street, Manchester.

Astern.—Towards the stern. To move astern; to launch astern; to drop astern. An object or vessel that is behind another vessel or object.

A-taunto.—With all the masts on end, and rigging completely fitted. (See "All-a-taunto.")

Athwart.—Transversely, at right angles to fore and aft; across the keel. Athwart-ship is thus across the ship from one side to the other. Athwart hawse is when one vessel gets across the stem of another.

A-trip.—When the anchor is broken out of the ground or is a-weigh. A topmast is said to be a-trip when it has been launched and unfidded.

Avast.—Stop, cease, hold, discontinue. As avast heaving (stop heaving), avast hauling (stop hauling), &c.

Awash.—Level with the surface of the water.

Away.—A general order to go, as "away aloft," for men to go into the rigging; "away aft," for the men to move aft, &c. "Gig's away there," a "cutter's away there," or "dinghy's away there," is the common way of giving the order to get the boats ready and manned. "Away with it," to run away with the fall of a tackle when hauling upon it. "Away she goes," said of a vessel when first she moves in launching.

A-Weather.—The situation of the helm when it is hauled to windward. To haul a sail a-weather is to haul the sheet in to windward instead of to leeward, to form a back sail, to box a vessel's head off the wind or put stern way on her. Generally to windward.

A-Weigh.—Said of the anchor when it is a-trip or broken out of the ground. The anchor is weighed when hove up to the hawse pipe.

Axioms for Yachtsmen by an American.—Don't stand up in a boat; don't sit on the rail of a boat; don't let your garments trail overboard; don't step into a boat except in her middle; don't stand up in a boat before you are alongside; don't pull under the bows of a ship—it looks green, and the consequences might be fatal; don't forget to "in fenders" every time you shove off; don't forget that a loaded boat keeps headway longer than a light one; don't make fast with a hitch that will jam; don't lower away with the plug out; keep the plug on hand by a small lanyard to it, so that it cannot be "led astray" and have to be hunted up when needed. Do.—Do hoist your flags chock up—nothing betokens the landsman more than slovenly colours; do haul taut all your gear; do see that no "Irish pennants" are flying adrift aloft; do have a long scope out in a gale; do see that your crew keeps in its place and does not boss the quarter deck; do keep your men tidy and looking sailor-like; do keep to leeward of competing yachts when you are not in the match yourself.

Aye Aye, Sir.—The response made by seamen when an order or direction is given them, to show that they understand and will obey.

B.

Back.—To back a sail, is to haul the sheet to windward.

Back and fill.—To luff up in the wind, and then fill off again. Often a vessel is worked up a narrow channel with a weather tide by backing and filling: that is, the helm is put down slowly, and the vessel kept moving until she is nearly head to wind; the helm is then put smartly up, and the vessel filled again. Care must be always taken to fill before the vessel loses way. Figuratively, to back and fill is to blow hot and cold, or assent and dissent, or to go backwards and forwards with opinions.

Backing.—Timber fitted at the back of other timbers.

Backstays.—The stays that support the topmast with a beam or stern wind. The topmast shrouds or rigging (See "Shifting Backstay, and Preventer.")

Backwater.—The water thrown back when waves strike a wall or other solid object. The water that appears to follow under the stern of a ship. To back water is to move the oars of a boat, so that the boat moves astern instead of ahead.

Baffling Wind.—A wind that is continually shifting its direction, so that it is difficult to keep the sails full or steady.

Bag.—Sails are said to bag when they do not sit flatly.

Bagpipe.—To bring the sheet of an after-sail, such as the mizen, to the weather rigging, so that the sail forms a bag, or back sail: useful to put stern way on a vessel.

Balance Lug.—(See page 145.)

Balance Reef.—In gaff sails a band with reef points or eyelet holes for lacing, sewn from the throat to the clew. The reef is taken in by lowering the jaws down to the boom and lacing the sail along the reef band to the boom. Sometimes the gaff end is lowered down to the boom end; in which case the reef band is laced along the gaff.

Bale.—To throw water out of a vessel or boat by buckets or balers.

Balk.—A hewn tree; a piece of timber for masts, &c.

Ballast.—A ship is said to be in ballast when she has no merchandise on board, but only sand, gravel, mud, or rubbish as ballast. (See page 47.)

Ballast.—To keep clean or sweeten. The ballast of an old vessel should be removed every other season, scrubbed, and whitewashed with hot lime, or coated with black varnish or red lead. The hold of the yacht should at the same time be thoroughly cleansed and black varnished or red leaded. A mixture of two-thirds Stockholm tar and one-third coal tar boiled together will make a good composition for the ballast and the inside of a vessel below the floor. Some vessels are now regularly hauled up every year, and of course their ballast is taken out and stored. (See "Laying up" and "Limber Boards").

Ballast, Run, into a Vessel. — Several racing yachts built with floors as shown by Fig. 19, page 79, have had ballast run into them, but the plan has fallen into disuse owing to the great labour of cutting the lead out again in case alterations became necessary; and moreover with a little trouble ballast can be moulded to fit into every cavity, however small, between the floors and keel.

Ballast, To Shift from Inside to the Keel.—The quantity of ballast that can be removed from inside the hull whilst the same stability is maintained by placing a certain amount of metal on the keel, can be ascertained as follows: before the vessel is hauled up to have the metal keel fixed, perform the following experiment: take a quantity of ballast (say 10cwt. for a 20 tonner) from the hull and place it on one side of the deck; mark on the vessel's side the line to which she is heeled; after the metal keel has been fixed and the vessel launched, put exactly the same weight of ballast from the hull as before on the side of the deck in exactly the same place; then remove ballast from the inside until the vessel heels to the line she did before the metal keel was fixed. The experiments should be performed in perfectly smooth water. (The result can be arrived at by calculation, as explained in "Yacht Designing," but the process requires too many figures to introduce here.)

Ballast, Shifting.—To put ballast in the weather side of a vessel during sailing. This practice is now strictly forbidden in yacht racing, and if a man were known to practise it he would be shunned as a thoroughly dishonest person.

Balloon Sails. — Balloon canvas is a term applied to sails of large dimensions, made of light canvas, and generally only used in yacht matches. A balloon jib fills up the whole space from the bowsprit end, masthead, and mast at deck; a balloon foresail is hanked to the forestay, but the foot reaches some distance abaft the mast; a balloon topsail has a yard nearly as long as the yacht is long over all, and the foot extends beyond the gaff on a jack yard; a balloon maintopmast staysail, has an up and down weather leech extending below the lower corner of the sail, which is hanked to the maintopmast stay (see Fig. 23, page 93). A jib topsail is sometimes termed a balloon sail, but now it is generally considered a "working sail." Balloon jibs are going out of fashion, as "bowsprit spinnakers" are now more generally used, and are more easily handled. In cutters, jack yards for balloon topsails are generally dispensed with, but are still used in yawls and schooners; but the latter seldom now have a jack yard for fore topsail.

Bare Poles.—With no sail set. With all the sails furled or stowed at sea for scudding before a heavy gale, or sometimes for lying to.

Bargee.—A seaman employed on board a barge.

Bar Harbour.—A harbour that has a bank or bar of sand or gravel at its mouth, so that it can only be entered at certain hours of the tide.

Barque.—A ship without yards on her mizen mast.

Barquentine.—A vessel square rigged on her foremast, and fore-and-aft rigged on her two other masts.

Barra Boats.—Vessels common to the Western Isles of Scotland, with almost perfect V section.

Barrel.—The part of a capstan, windlass, or winch round which the cable or rope is wound whilst heaving.

Base Line.—In naval architecture a level line near the keel, from which all heights are measured perpendicularly to it. In most drawings the load water-line is made the base line, and all depths and heights are measured perpendicularly or at right angles to the load water-line, as shown in the Sheer Plan.

Batten.—A long piece of wood used to lash to yards or booms to strengthen them. Thin pieces of hard wood fitted to spars to prevent their being chafed or cut. Thin splints of wood used by draughtsmen to make curved lines. Generally a thin strip of wood.

Batten Down.—Putting tarpaulins over hatches or skylights, and securing them by iron bars or battens.

Beach.—A Shore. To beach is to lay ashore, to strand.

Beach Boats.—Flat floored boats that can be readily beached. (See page 164.)

Beacon.—A stake, boom, or post put on a sand bank or shoal as a warning for vessels.

Beacon Buoy.—A buoy with a kind of cross upon top of it.

Beadon's Safety Reel.—Used for belaying the main sheet. This was a contrivance invented in 1833 described in "Folkard's Sailing Boat." This reel is said to have been contrived without cogs or catches, and released the main sheet upon the boat being held to a certain angle (See "Cruickshank's Patent Cleats".)

Beam.—A timber that crosses a vessel transversely to support the deck. The breadth of a vessel. Before the beam is forward of the middle part of a ship. The wind is said to be before the beam when the ship makes a less angle than 90° with the wind. A beam wind is a wind that blows at right angles to a vessel's keel. Abaft the beam is towards the stern.

Beam and Length.—The proportion a vessel's beam bears to her length. A quarter of a century ago, it was considered that this proportion had a great deal to do with speed, hence many builders set great store on the particular amount of beam to length they gave a vessel. A yacht was seldom made more than four times her beam in length, but now a common proportion is five times the beam. It is generally contended that the builders' rule and Thames rule for ascertaining tonnage have a great deal to do with the diminishing of breadth in its proportion to length, and so no doubt it has, inasmuch as an owner finds that, if he builds, say, a yacht of 100ft. in length, he gets practically no more room in her, if he makes her 22ft. in breadth, than he would if she were only 21ft. It would of course be an advantage to the builder to make the yacht 22ft. in breadth, as her tonnage would be 189 tons, instead of 185; so he would be paid about 200*l.* more for the foot extra beam, and practically there would be nothing to show for it. In sailing yachts it is not found prudent to make the length much exceed five times the beam, and hitherto results seem to show that a better proportion is four and a half times the beam. A yacht that has a beam of only four times her length need be rather shallow, or she would have a very large displacement and would be slow; on the other hand, shallow vessels are not good sea boats. The comparatively deep and long-bodied vessels make the best sea boats. They are of a good weight, which tends to lessen the influence of the waves on their motions, and they are easier in their motions with a beam sea. (See the chapters on "Resistance and Speed," page 41; "Ballast," page 47; "Spars," page 52.)

Beam Ends.—A vessel is said to be on her beam ends when she is hove down on her side by the wind or other force, so that the ends of her deck beams are on the water, or her deck beams perpendicular to the water.

Bear.—The direction of an object from a ship expressed in compass points or by points in the vessel; as in reference to another vessel she bears S.E. or W.S.W., &c., or on the port bow, or weather bow, port beam or weather beam, port quarter or weather quarter, &c.; or two points on the weather bow or port bow, &c.

Bear a Hand There.—An admonition to hurry.

Bear Away or Bear Up.—To put the helm up and keep the vessel more off the wind. Generally used in close-hauled sailing when a vessel begins to alter her course by sailing off the wind. (See "Wear.")

Bearings.—The direction between one object and another; generally the direction of an object on land to a ship. The widest part of a vessel which may either be above or below water. A vessel is said to be on her bearings when she is heeled over, so that her greatest breadth is in the water.

Bearings by Compass.—An object is said to bear so many points on the port or starboard bow, or port or starboard quarter, or port or starboard beam as the case may be; or an object may be said to bear E.N.E. or E. or W., &c., from the point of observation. The usual plan of taking a bearing is to stand directly over the binnacle, and notice which point on the compass card directly points to the object. A more accurate way of taking bearings may be followed thus: on each quarter-rail abreast of the binnacle, have a half compass plate of brass fixed, and let two opposite points (say north and south) be in direct line or parallel with the keel. A pointer or hand, eight or nine inches long, must be fitted to the plate, to ship and unship on a pivot; move the pointer until it points directly to the object, then read off the number of points it is from the direction of the ship's head. Next observe the direction of the ship's head by the binnacle compass; if the ship's head points N., and the pointer showed the object to be, say, four points away westerly from the direction of the ship's head, then the object will bear N.W., and so on. If very great accuracy be required, and if the ship be yawing about, one hand should watch the binnacle compass, whilst another makes the observations with the pointer.

An object is said to bear "on the bow" if its direction in relation to the ship does not make a greater angle with the keel of the vessel than 45°. If the direction of the object makes a greater angle than that it would be said to bear "before the beam;" on the beam, abaft the beam, on the quarter, right astern.

Beat.—To beat to windward is to make way against the wind by a zigzag course, and frequent tacking. (See "Thrashing" and "Turning to Windward.")

Beating to Windward.—(See "Beat.")

Becalm.—To deprive a vessel of wind, as by one vessel passing to windward of another.

Becalmed.—In a calm; without wind.

Becket.—A piece of rope used to confine or secure spars, ropes, or tackles. Generally an eye is at one end; sometimes an eye at either end; or a knot at one end and an eye at the other.

Beef.—Strength; generally the weight of the men hauling on a rope. "More beef here" is a request for help when hauling.

Before the Beam.—Towards the bow or stem of a vessel.

Before the Mast.—A term used to describe the station of seamen as distinguished from officers. Thus a man before the mast means a common sailor, and not an officer. The term owes its origin to the fact that the seamen lived in the forecastle, which is usually "before the mast."

Before the Wind.—Running with the wind astern.

Behaviour.—The performance of a ship in a seaway or under canvas is generally termed by sailors her "behaviour."

Belay That.—Slang for cease talking or fooling.

Belay, To.—To make fast a rope or fall of a tackle. In hauling upon a rope the signal to cease is usually, "Belay!" or "Belay there!" or "Avast hauling!" "Belay!"

To belay the mainsheet in small boats where the sheet travels on a horse through a block. The block will travel on the horse by a thimble eye strop; the sheet will be spliced to the clew cringle in the sail and rove through the block. Bring the fall of the sheet down to the pin under the stern seat, round which pin take a single turn; then take a bight and jam it between the sheet and the seat, and a slight pull will release the sheet. The sheet can be belayed in the same fashion by a turn taken under a thole pin in the gunwale; or a bight of the fall can be taken and made fast round the sheet above the block by a slippery hitch.

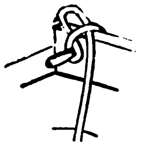


Fig. 91.

A plan recommended by Mr. Wilcox for a single sheet is shown in the accompanying sketch. A pin is fitted into the transom as shown. The fall of the sheet is brought round the pin outside the transom, then round the pin inside the transom, and a bight jammed in between the transom and sheet.

Belaying Pins.—Pins in racks, in cavels, spider hoops, &c., to make fast ropes to.

Belay there!—An order given to cease hauling and make fast the rope.

Bell Buoy.—A buoy with an iron cage upon top of it, with a bell which is struck by a hammer moved by the heave of the sea.

Bells.—The manner of keeping time on board ship by striking a bell every half hour. Thus one bell is a half hour, as half-past twelve; two bells one o'clock; three bells half-past one, and so on until eight bells are struck, which would be four o'clock. One bell would then be begun again and proceed up to eight o'clock. Thus eight bells are struck every four hours, the duration of a watch (see "Watch"). (See page 278.)

Below.—A general term for the under-deck space. To go below is to descend from the deck to the cabin, or to under the deck. A seaman always goes "below," and never "downstairs," and it is considered very green and landsman-like to hear a person on board a vessel speak of going "downstairs" for below, or upstairs for "on deck."

Below, or Below There!—A mode of hailing or attracting the attention of the crew below by those on deck.

Bend.—To fasten a rope to another; to fasten a rope to a spar; to bend a sail to a yard, &c. A knot, a mode of fastening a rope to a spar, &c.

Bends.—The wales of a ship. Stout planks on the side of a ship.

Beneaped.—Aground for want of water, owing to neap tides.

Bermudian Rig.—The mast of a Bermuda rigged boat is very long, and is placed far into the bow, which is usually very bluff. The mast rakes aft, and the sail set upon it is of the well-known sliding gunter shape. The objection to the rig is the long heavy mast placed in the eyes of the boat, and although the sail stands well when hauled in on a wind, yet off the wind it causes some trouble, as it is almost impossible—except in very strong breezes—to keep the sail from falling on board.

Berth.—The situation of a ship when at anchor. A place to sleep in; a cabin. Employment.

Berthon's Collapsible Boats.—These boats were invented by the Rev. E. Berthon in 1851. They are made upon longitudinal frames with a double skin of stout canvas. When collapsed the gunwales fold outwards, back flat on the keel. A 7ft. dinghy which might suit a 5-ton yacht, will have 3ft. beam, and when folded only require space of 7ft. × 2ft. × 6in. The weight of such a boat is about 40lb.

A small boat 10ft. long weighs, with all the gear, about 80lb. A yacht's gig 26ft. long, 5cwt. Boats as light as 40lb. are built. The price of a boat 10ft. long is 14 guineas. The following sketch shows the boats open and collapsed.

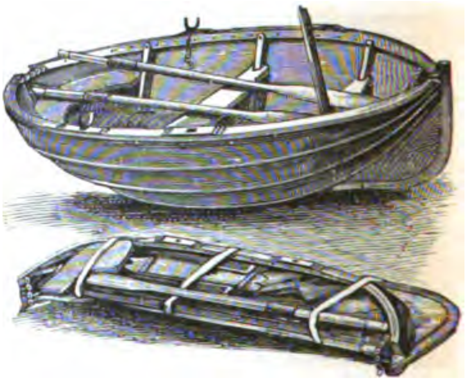


Fig. 92.

Berthon's Logs, or Speed Indicators.—A log invented by the Rev. E. Berthon. A tube passes through the keel, and the water rises in this tube in proportion to the speed of the vessel through the water. A simple mechanical contrivance of weight, line, and pulley serves to indicate the speed on a dial.

Bevel.—In shipbuilding, the departure from the square a timber is made take to suit the inclination of a plank. An oblique edge of a piece of timber or plank.

Bevelling Board.—A piece of wood used by ship builders on which the angle of the bevels for timbers are to take are marked in lines.

Bibs.—Pieces of timbers fastened to the hounds of ships' masts to support the trestle trees.

Bight.—A loop or part of a rope doubled so as to form a loop, thus ∩. The deepest part of a bay.

Bilge.—The round in a vessel's timbers where they begin to approach a vertical direction. (See page 92.)

Bilged.—A vessel is said to be bilged when her framing is broken in, or damaged along her bilge by grounding, or falling down when shored up by the side of a wharf.

Bilge Keels.—Pieces of timber fitted longitudinally on a vessel's bottom, so that she may take the ground readily and not damage her bottom. Bilge keels, however, now fulfil different offices and are fitted to large ships to assist in checking their rolling. The Brighton beach boats are fitted with bilge keels, and it has been argued that they prevent a boat making lee way; of course only the lee bilge keel can so operate, and the effectiveness of this one would be greatly interfered with by the disturbed state of the water near it. Bilge keels, if very deep, would affect very greatly a boat's handiness in tacking; also the lee one would assist in heeling the boat to an extent dependent upon the force of the lee way, and the area of the bilge keel; on the other hand, bilge keels will tend to check the sudden heeling of a boat, for the same reason that they cause the process of rolling to be more slowly performed.

Bilge Kelsons.—Stout pieces of timber fitted inside a vessel in a fore-and-aft direction along the bilge to strengthen her.

Bilge Strakes.—Thick plank worked in the ceiling of a vessel inside along the bilge to strengthen her—used instead of bilge kelsons.

Bilge Water.—The water inside a vessel, which in flat-floored crafts may rest in the bilge.

Bill.—A point of land; also the extreme points of the flukes of an anchor.

Bill Boards.—Pieces of wood fitted to the bow of a vessel to protect the plank from the fluke of the anchor.

Bill of Health.—A document wherein it is certified that the condition of the crew is healthy or otherwise. Hence a clean bill of health means that all the crew are free from disorders, and a foul bill of health the contrary.

Bill of Lading.—A document setting forth the cargo of a ship, certified by the master.

Bill of Sale.—A document by which a vessel is transferred from one owner to another. Forms of Bill of Sale can be procured from Waterlow and Sons, printers and stationers, London.

Billy Buoy.—A bluff bowed vessel, common in the north, rigged with one mast, and commonly with a square topsail.

Binnacle.—A case wherein the compass is contained.

Bird's Nest.—(See "Crow's Nest.")

Birlin.—A rowing and sailing boat of the Hebrides.

Bitter End.—The end of a cable inside the bitts. The extreme end of a rope.

Bitts.—Stout pieces of timber fitted in the deck to receive the bowsprit; also stout pieces of timber fitted in the deck by the side of the mast, to which the halyards are usually belayed.

Black Book.—A book kept at the Admiralty, or said to be, wherein is recorded the offences of seamen. Several yacht clubs have kept "black books," but they have been of little use, as owners showed a disinclination to insist that no man should be engaged in his yacht who was on the "black book."

Black Paint.—A good mixture for the outside of a boat is thus made: to 6lb. of best black paint add half pint of good varnish and ½lb. of blue paint.

Black 9lb.; raw linseed oil 1 quart; boiled linseed oil 1 quart; dryers ½lb.

For an iron yacht: 1cwt. of Astbury's oxide of paint; 6 gallons of boiled linseed oil; 1 gallon of turpentine; 3 gallons of varnish; 21lb. dryers. (Messrs Astbury's, King-street, Manchester.)

Blacking Down.—Painting or tarring the rigging, or sides of a ship.

Black Jack.—The black flag hoisted by pirates.

Blackwall Hitch.—A hitch used to jam the bight of a rope to a hook, &c.

Blade.—The flat part of an oar.

Blind Harbour.—A harbour whose entrance cannot readily be made out from a distance.

Blisters.—Unsightly blisters on paint are generally caused by putting new paint upon the top of old. The old paint should be burnt or scraped off.

Block.—A pulley. A single block has one sheave; double, two; three-fold or treble, three; and so on (See "Fiddle block.)"

Block and Block.—Chock-a-block. When the blocks of a tackle are hauled close together. A vessel is said to take her main sheet block and block, when the boom is hauled so much aboard that the two blocks come close or nearly close together.

Blow, A.—A gale of wind.

Blue Jackets.—Sailors.

Blue Peter.—A blue flag with a white square in the centre; hoisted at the fore truck as a signal that the vessel is about to go to sea. Sometimes for brevity called Peter.

Blue Water.—The open sea or ocean.

Bluff.—A wall-like headland.

Bluff-bowed.—Very full bowed, thus ⊃.

Board.—In beating to windward a board is the time a vessel is on one tack and the distance she makes on that tack. Thus it may be a long board or a short board. Working to windward by a long board and a short board is when a vessel can more nearly lie her course on one tack than on another. Thus, suppose the wind be S.W., and the vessels' course from headland to headland S.S.W., and the vessel can lie four points from the wind; then on the starboard tack the vessel will head S., or two points off her course; on the port tack she will lie W., or six points off her course. The long board will be the one on the starboard tack. A vessel is said to make a good board when the wind frees her on one tack; a bad board when it heads her. A stern board is to get stern way on whilst tacking. To board a ship is to enter upon her deck, generally supposed to mean without invitation. "By the board" to fall close by the deck. A mast is said to go by the board when it breaks by the deck and falls overboard.

Board and Board.—Vessels are said to work board and board when they keep in company and tack simultaneously.

Boat Building.—In the first place lay off the sections, keel and sternpost, and stem as described page 127. [If the keel has a straight edge, top and bottom, it will not require to be laid off.] When the sections are laid off, proceed to make moulds to fit the curves; these moulds will be made of ½ inch or ⅝ inch deal or elm, any odd pieces of stuff will do, and there can be as many joints in a mould as may be found convenient: (See Fig. 93) The cross piece A should be stout enough to keep the mould rigid. The diagonal braces D need not be used if the mould can be made rigid without them; in such case the joints in the mould should be secured by a doubling piece. The bar W.L. represents the load-water-line. B is the part that fits on the keel and represents the "joggle" in the floor-timber. The cross piece here should be securely attached and fixed so that the joggle is of the proper depth. A nail on each side of the mould, or a couple of pieces of wood nailed to the keel, will keep the mould in position on the keel.

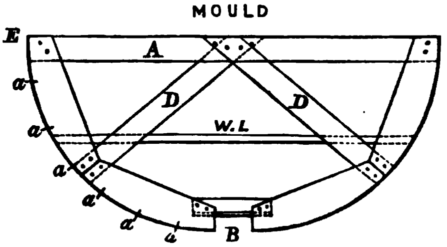


FIG. 93.

The outer edges of the mould must be planed up to fit the curve of the section as drawn on the mould loft. When floors or timbers have to be sawn out, and not steamed, the mould is laid over the timber and its shape marked on it by pencil or chalk.

The stem and sternpost are tenoned into mortices in the keel; but if the keel be not thick enough to take a tenon, the keel and stem, and keel and sternpost are box-scarphed together by halves: that is, half the thickness of each is cut away.

In all the drawings of small boats given in the body of the book, the load-water-line is made the base-line, and therefore everything must be plumb to that.

Having got the stem, sternpost, and keel shaped and put together proceed to fix them to the stocks. [A deal firmly fixed edgeways at a convenient distance from the floor—high enough to enable the builder to drive the nails up through the bottom of the boat—will make the stocks.] A straight edge or line must be fitted from stem to stern-post to represent the load-water-line as shown on the Sheer Plan: (See Plate IV.)

Also a stout bar of wood must be nailed to stem-head and stern-post-head, above the one marking the L.W.L., to firmly connect the two; this bar will be found useful for nailing the mould stays to.

In fixing the keel frame on the stocks it must be wedged up forward until the line or straight edge representing the load-water-line is perfectly level or horizontal. A spirit level or plumb level can be used for this adjustment.

Fit the dead wood knee aft, and the stem knee or apron forward. Bore the holes for the through bolts with a long augur or gimlet. The heads of the bolts will be inside, and clenched outside over a ring: (See Plate III.)

Next the transom must be cut out from a mould and let into the sternpost and through bolted, as shown Plates III. and IV. The edges of the transom will require to be bevelled to suit the fore-and-aft curve of the boats.

When the keel, stem and sternpost are on the stocks and in position (the stem and sternpost must be plumbed to see that they neither cant to port nor starboard), they must be secured by stays; the stays will be bars of wood and reach from the stemhead and head of sternpost to the floor or ceiling, and they must be securely nailed. The keel can be kept in its position by similar stays; or if the keel be quite straight on its underside it can be kept in its position by thumb cleats nailed to the deal forming the stocks.

The lower edge and upper edge of the rabbet in the keel, stem and stern dead woods must be next set off, and cut out with a chisel. The aft dead wood will probably require some adzing away back to the rabbet.

The moulds must be next put into their proper places. Care must be taken that they are "square" to the keel (*i.e.*, cross it at right-angles) that they are plumb (perpendicular) to the load-water-line, and that the bar W L is at the level of the line stretched between stem and stern-post to represent the load-water-line. The moulds must be kept in position by wood stays. Sometimes all the moulds are not fixed; but if there are no more than shown in Plate IV., they should be all fixed.

The planking will next be proceeded with. The width of the strakes will be in the widest part about 4½ or 5 inches. Measure the half-girth of the midship mould from B to E by passing a tape or line round the outside curved edge. Divide this length into a number of equal intervals to represent the breadth of the strakes as *a a*, &c. (see Fig. 93). Allowance must be made for about ¾in. overlap of each plank which forms the lands.

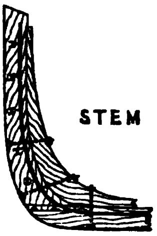


FIG. 94.

Count the number of intervals or strakes of plank, and set off the same number in equal intervals on the rabbet of the stem (see *x x*, Fig. 94) and on the transom. These intervals will be much closer together, and will therefore show that the plank must taper towards the ends. The same number of intervals can also be set off on the intermediate moulds.

The garboard strake will be first fitted. This will be a strake quite straight on its upper edge before it is bent round under the moulds from stem to stern post. The under edge will be cut to fit the rabbet in keel, stem, and dead wood aft. When this plank has been fitted into the garboard and nailed at intervals of two or three inches to the keel, the next plank must be fitted. Take the board (out of which the plank is to be sawn) and hold it along as closely as possible to the upper edge of the garboard strake. Mark a line along it to correspond with the top edge of the garboard. Remove the board and it will be found that the line is more or less curved. Saw down this curved line. Then fit the board to the garboard again, this time making it overlap (by its curved edge) the garboard by about ¾ of an inch. Now mark by spots on the board the next interval, representing the breadth of the plank (see *a a*, &c., Fig. 94) for each mould, including stem and dead wood or transom aft. Remove the board and run a line in through the spots representing the intersections with the moulds; this will show the shape, or the curve of the upper edge, and the curve of the lower edge of the next strake. The plank may possibly be shaped like the sketch (Fig. 95), but the greatest curvature will be found as the bilge is reached. It is not absolutely necessary that the plank should accord with the spots at every mould, as the intervals are more as a guide to get the curve of the strake than to show the shape of the curve arbitrarily.

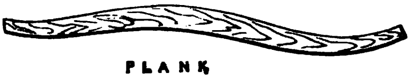


FIG. 95.

When the strake has been cut out it will be planed and then fitted to overlap the garboard; whilst it is being nailed it will be held in position by a number of clamps (at intervals of two or three feet.)

The clamps are made of two pieces of hard wood loosely connected by a screw bolt (see Fig. 96) and has a wedge. The bolt must be allowed plenty of play, so that when the clamp grips the strakes it can be wedged up tightly as shewn.

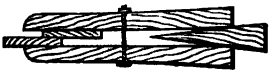


FIG. 96.

The plank will be nailed together at intervals of 3 inches. The nails will be of copper, and will be rooved and clinched inside. At the stem and transom, the upper part of each strake is thinned away in order that the hood ends may fit into the rabbet flush.

To get the strakes round the bilge in a fair curve the upper outer edge of each strake is bevelled off (see Fig. 69, page 216), and sometimes the inner lower edge of the overlapping strake is also bevelled.

Holes should be bored for the copper nails by a sharp bradawl a little smaller than the nails. The roove having been put over the nail, the latter will be cut off by a pair of nippers, leaving about $\frac{1}{16}$ of an inch projecting above the roove. A "holder on" will be held to the head of the nail outside the boat, and the nail will then be clinched down over the roove inside the boat.

The boat being now planked up to the top strake, the floors and timbers must be put in. If the boat is a large one, such as the Brighton Beach boats (not the New Brighton boats, which are carvel built), the floors will be sawn out of timber of a suitable size (see page 165) and joggled (see Fig. 97). The floors should extend across the keel and into the turn of the bilge; they will be fastened through the keel with a Muntz-metal, or copper, or galvanised iron bolt, and, if thought necessary, clenched with ring. A copper nail will be driven through the plank (where two strakes overlap), and be clenched on the top of the floor; frequently rooves are not used for these fastenings. A fastening is put through every overlap.

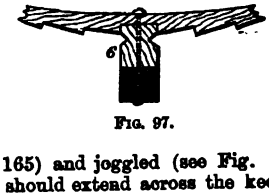
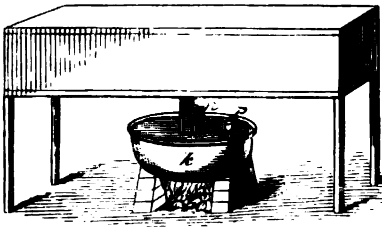


FIG. 97.

The timbers should be sawn out of a straight-grained piece of American elm, but sometimes English oak or ash is used; oak is generally preferred for the floors, and American elm for the timbers. The timbers, having been sawn out, must be planed up, and will then require steaming to get them into their places. The timbers should extend from one gunwale across the keel to the other gunwale, but frequently, where stout floors are inserted, the timbers are not worked across the keel, and do not reach within 6in. of the keel; in such cases the timbers are in "halves."

A steam chest or kiln will have to be constructed (see Fig. 98). In length it should be a foot or so longer than the longest timber, and be a foot deep and a foot broad. It should be made of 1½in. deal. The end, *a*, is a door. Inside on the bottom should be nailed three or four cross pieces of wood, 2in. deep, for the timbers to rest upon, forming a kind of rack.



STEAM KILN

FIG. 98.

Steam can be generated in a common three-legged pot set up on bricks (see *k*). The pot should contain three or four gallons of water. The cover will be made of wood, cemented round with clay or mortar. *n* is a steampipe (made of inch deal, inside size 3½in. by 3½in.); *p* is a plug for the water supply. The door, *a*, should fit inside the steam chest, and fillets of inch deal must be nailed inside for the door to rest against. Before putting the door in its place, clay or mortar should be smeared round the fillets to keep the door from leaking. The door need not be hinged, but can be kept in its place by a cross-bar of wood working through two staples driven into the ends of the chest.

The timbers will require steaming three or four hours before they are sufficiently pliable. They must be taken from the steam chest and fitted into the boat one by one; the first fastening to put in will be the one through or in the keel (a Muntz-metal dump is best for this). Press with the foot or hands the timber into the bilge, and put a fastening through it here (from the outside). The stations for the timbers should be previously marked across each plank strake, and the holes through the overlaps should be bored before putting the timber in.

If the timber has to be joggled to receive the inside edges of each strake (see Fig. 97), the fastenings must not be clinched as the timber will have to be removed for the joggles to be cut. The timbers, however, should not be removed until they are perfectly cool and rigid; they should be allowed to stay in the boat a day and night before removing.

The gunwale must now be fitted (this is more properly termed the "in-wale," as it is the piece of timber which is fitted *inside* the top strake; it answers the purpose of the "clamp" used in larger boats). Having decided upon the size of the wale—its depth and thickness—it must be fitted. In the first place, the timber heads are cut down inside the top strake to the depth of the wale [one plan is not to cut the timbers so low as this by half an inch, and make joggles in the wale to receive the head of each timber; when this is done, however, the wale or clamp should be somewhat stouter, as it will be weakened by the joggles]. Usually the wale is flush with the top strake; but a better plan is to cut a rabbet in the wale (see Fig. 69, page 216) to fit over the top strake. A nail is put through the top strake and wale (from the outside), and rooved or clinched without a roove, inside. A nail is put through about every 4, 5, or 6 inches. Forward, the wale top strake, stem, and apron are kept together by a breast-hook or >-shaped knee (see sketch A, Plate III., page 128). Aft, the wale and top strake are secured to the transom by a knee (see *m*, Half-breadth Plan, Plate III.). The thwarts will rest on the stringers (which are fastened through timbers and plank), as shown by *a a* and *b b*, Sheer Plan, Plate III. The thwarts are secured by knees, as shown Fig. 69, page 216. The knee is fastened through and out the wale and top strake, and with a long fastening through the overlap of strakes, and clenched with ring on the knee; there will also be fastenings through the thwart and knee.

In buying copper nails care must be taken that "land nails" are obtained for the plank fastenings, and "timber nails" for the timber fastenings. The rooves must match the nails. A rooving iron (which is simply a kind of punch with a hole in its end) will be required to drive the rooves on whilst a hammer is held to the head of the nail. The sizes of the plank nails will depend upon the double thickness of the plank; about one-sixth of the double thickness should be added to the length of the nails for rooving and clenching.

If the boat is to be decked, a clamp or kind of shelf must be fitted to the timbers, and thoroughly fastened at each timber. The clamp will be fitted low enough for the beams to come flush with the top strake. The beams will be arched as required, and fastened through the shelf, much in the same way as shown by Fig. 21, page 81. The top strake should be of sufficient thickness to take the fastenings of the covering board. The covering board should be of hard wood, such as oak, and must be cut to fit the curve of the deck, as shown in the Half-breadth Plan.

The deck plank will be nailed to the beams by galvanised nails; not *through* the plank from the top downwards, but diagonally through the side edges of the plank into the beams.

The under edges of the plank will meet closely on the beams; but the upper edges will "gape," as shown, in an exaggerated way, by *a a*, Fig. 99; this is for the caulking. An eighth of an inch will give a wide enough seam. The oakum or cotton thread (a couple of threads will be enough for inch plank) must be driven in tightly by the caulking chisel, and then payed with marine glue or stopped with putty (see articles on these subjects). Generally the arch of the beams will give the seam opening enough, as at *a a*; but, where it will not, the plank should be bevelled to the extent of a shaving or two. The seam round the covering board should be well caulked and payed.

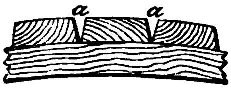


FIG. 99.

A hanging knee should be fitted on each side under the beam abreast of the mast or rigging (see *n*, Fig. 21, page 81). If the boat is wholly decked, three pairs of such hanging knees should be fitted.

If the boat is half-deck, waterways should be fitted. Short beams will be worked for these, and their inner ends will be butted into a fore-and-aft piece, which fore-and-aft piece will in turn be butted into the full beams at either end. Two or three pairs of hanging knees (made of oak) will support the waterways.

Chain-plates for the rigging will be fitted as shown by Fig. 68, page 214.

Boat Chocks.—Pieces of wood with a score in them to take the keel of boats when they are lifted in upon deck.

Boat for Rowing or Sailing.—The following is a description of a boat built at Exmouth for rowing or sailing:—

Extreme length, 14ft. 2in.; beam, 5ft. 1in.; depth, 2ft.; elm plank, ⅜in. thickness; American elm timbers, steamed, ¾in. by ⅜in.; all copper fastened, with copper stem, band, and rudder hangings; gunwales, American elm, 1¼in. by 1in.; keel, elm, 2½in. wide, 4in. below the garboard strake; false, 4in. aft, running to 3in. forward; three thwarts, the first from the stem 3ft., second 5ft. 11in., third, 8ft. 10in.; seats round the stern, width 1ft., thickness, 1in.; ballast, when single-handed, three bags of beach gravel, length, 1ft. 11in., width, 1ft. 5in., weighing each about a hundredweight; with three hands on board one bag can well be dispensed with, with four only one bag is in ordinary weather requisite; sails, sprit mizen, lug foresail, and jib. The following are the dimensions of the sails:—Jib, on the luff, 10ft. 6in.; hoist or leach, 8ft.; foot, 6ft. 6in.; lugsail, which is in fact the mainsail of the boat, 5ft. 4in. on the luff; head 9ft. 6in., leach 14ft. 6in., foot 9ft. 4in.; a sprit mizen, measuring on the luff 5ft., on leach 8ft., on the foot 4ft.; length of sprit, 8ft. 1in.; length of bowsprit, 7ft. 10in.; diameter at outer end, 2in.; at heel, 2½in. Mast as long as can conveniently stow inside the boat on the thwarts; diameter at top, 2¼in.; at level of the thwarts, 3in.; distance of mast from the stem, 1ft. 9in., which is stepped through a fore and aft thwart, meeting the front thwart and extending forward until it butts against the apron piece at the back of the stem. The lug has a little boom, 2in. diameter at the mast, and 1½in. at the after end. In lieu of jaws or gooseneck a hole is bored through the end where the jaws would be, to receive the tack of the lugsail, which is knotted below the boom, and thus keeps the boom in its place close to the mast, where a hole is bored also through the thwart to receive the tack, one inch abaft the mast hole. The arrangement of the main sheet is as follows:—On the foreside of the afterthwart two wedge-shaped cleats are nailed amidship against the edge, which form a notch an inch deep. The mainsheet has a small thimble in it, 18in. from one end, which is secured round the thwart and in the notch, hence it cannot slide from its position. Another thimble is attached to the boom by a grommet. The mainsheet is fast riven through the boom thimble, and then through the first-named thimble, just above the level of the afterthwart. The mainsail thus works from side to side in going about, without the usual trouble of shifting the sheet from gunwale to gunwale. This arrangement is convenient for beating up channels, river sailing, or at sea when mackerel or pollack fishing, where a constant change of course is necessary every few minutes. This boat was built for estuary and coast work, but is well adapted also for lake fishing, being steady on the water without ballast. For a freshwater lake or river it would be necessary to use fir or oak plank, as elm always decays at the water-line in about three years. Elm is especially liable to decay, as sailors say, "between wind and water," but if entirely submerged will endure for ages.

Boat Hook.—A wood pole with a metal hook and prong at one end; sometimes with two hooks. A yacht's gig has two such—one for the use of the bowman, another for the stroke; by these means a boat is held alongside the steps of a jetty or by the gangway of a vessel, &c.

Boat Keeper.—The man left in charge of a boat when the other part of her crew go on shore.

Boat's Crew.—Men told off to always man a particular boat, such as the gig, cutter, or dinghy of a yacht.

Boatswain.—An officer who takes charge of a yacht's gear, and it is his duty to superintend all work done upon the spars, rigging, or sails. He also takes charge of all spare gear and sails, and sees that everything on deck and above deck is neat, clean, and ship-shape. He must in every sense of the word be a thorough seaman, and must know how all work upon rigging and sails should be done. As he has constantly to handle the sails and rigging, he necessarily has a knowledge of their condition, and it is his duty to report all defects in the same.

Boatswain's Call.—A whistle consisting of a hollow ball and a tube leading to a hole in it. By varying the sounds the men are "piped" to their work just the same as soldiers are ordered by the sound of a bugle. The pipe is seldom met with in English yachts, not even in those of large size, and the boatswain has little to do with giving orders.

Bobstay.—The bowsprit stay. (See page 90.)

Body.—Part of a vessel's hull, as fore-body, middle-body, and after-body. A vessel is said to be long-bodied when the tapering of the fore-and-aft lines are very gradual; short-bodied when the fore-and-aft lines taper very suddenly; a long-body thus means a great parallel length of middle-body. (See "Straight of Breadth.")

Body Plan.—A plan which contains the cross sections of a vessel. The midship section or largest section is generally shown on the right-hand side of the middle line of the body plan; sometimes on both sides.

Bollard.—A stout timber to fasten ropes and warps to. The bollard timbers of a vessel are the same as the knightheads; originally the knightheads were carved figures (fitted near the foremast to receive the windlass), hence the name knightheads.

Bollard Timbers.—See "Knightheads."

Bolsters.—Pieces of hard wood bolted to the yoke or lower cap on the mast for the rigging to rest upon. They are sometimes covered with leather or sheepskin with the hair on, to prevent the rigging chafing. (See page 90 and 94.)

Bolt.—A fastening of metal. An eye bolt is a bolt with an eye in it used to hook blocks, &c., to. A ring bolt is a bolt with an eye and a ring in the eye. An ear bolt is a bolt with a kind of slot in it to receive the part of another bolt, a pin keeping the two together and forming a kind of joint (see C, Fig. 26, page 99). Bay bolts are bolts with jagged edges to prevent their drawing.

Bolt Rope.—The rope sewn round the edges of a sail. There is the weather (luff) rope, leech rope, foot rope, and head rope.

Booby Hatch.—A hatch on coamings used to give greater height in the cabin of small yachts, and which can be removed.

Boom.—A spar used to extend the foot of sails. To top the boom is to make sail and away. To boom off is to shove off a wharf, bank, &c., by the aid of spars. Stakes of wood used to denote shoal water.

Boom Irons.—Iron bands on booms with eyes, to which blocks or ropes may be hitched.

Boomkin.—A short boom of great strength, usually written "bumpkin."

Bonnet.—An addition to a sail by lacing a short piece to its foot; common in America, not often seen in British yachts.

Bore.—A sudden tide wave, which rolls along rapidly at certain times on some rivers, and makes a great noise.

Boreas.—The north wind. An old sailor's saying is, "as cold as Boreas with an iceberg in each pocket." Popularly the god that rules the wind, as Æolus is supposed to do.

Bore Away.—Did bear away. (See p. 296.)

Bore by the Head.—A vessel is said to bore by the head when she, whilst passing through the water, is depressed by the head. (See pp. 26 and 194.)

Boring.—When a vessel by bearing away or luffing forces another vessel to bear away or luff to avoid a collision.

Boss.—Yankee slang for sailing master, or chief in command.

Both Sheets Aft.—When a square-rigged ship has the wind dead aft, so that the sheets lead aft alike.

Bottom.—The part of a vessel usually understood as below the bilge.

Bottomry.—The hull or bottom of a ship pledged as security for a loan. If the ship be lost the money is lost unless the lender has covered himself by other means.

Bound.—The destination of a vessel. Wind-bound means that a vessel is in a port or at an anchorage because the wind is unfavourable for her to proceed. Formerly square-rigged ships were everlastingly wind-bound, *i.e.*, waiting in port because the wind was adverse; now they go out and look for a fair wind, and generally can sail so well on a wind that waiting for a fair wind would be considered an unpardonable piece of folly.

Bow.—The fore part of a vessel; forward of the greatest transverse section. In taking bearings an object is said to be on the bow if its direction does not make more than an angle of 45° with the line of the keel.

Bower Anchor.—The anchor in constant use.

Bow Fast.—A warp for holding the vessel by the bow.

Bowing the Sea.—Meeting the sea bow or end on, or nearly end on, as in close-hauled sailing.

Bowline Haul.—The foremost man in hauling on a bowline sings out, "One! two!! three!!! haul!!!!" the weight of all the men being thrown on the rope when the "haul" is shouted out.

Bowline knot.—Formed thus:

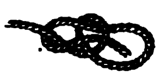


FIG. 100.

Bowlines.—Ropes made fast to cringles in the weather leech of squaresails, to pull them taut and steady when sailing on a wind. The bowlines usually lead into a bridle. Sailing on a bowline means sailing on a wind when the bowlines would be hauled taut; hence the phrase "sailing on a taut bowline." Sailing on an easy bowline means sailing with the sails well full, and the bowlines eased up a little, so that the vessel is not quite "on a wind" or close hauled.

Bow-lines.—Continuation of buttock lines, showing the outline of vertical fore-and-aft sections in the fore-body. (See "Buttock-lines.")

Bowse.—Hauling with a will upon a rope.

Bowsprit.—A spar projecting from the bow of a vessel. (See pp. 53, 54, 57, 91, and continuation). A running bowsprit is one that can easily be reefed in like a cutter's. A standing bowsprit is one fitted in a bed and generally prolonged by a jibboom.

Bowsprit Bitts.—(See page 93).

Bowsprit Cranse.—The iron cap at the bowsprit end, to which the gear is hooked; in the case of the vessel having a jibboom the cap is a double one to take the jibboom.

Bowsprit Shrouds.—(See pp. 93 and 107).

Boxhauling.—In tacking a ship to make her turn on her heel by hauling the head sheets a-weather, and getting stern-way on. Practised by square-rigged ships, sometimes in working narrow channels.

Boxing off.—Assisting to pay a vessel's head off the wind by hauling the head sheets a-weather.

Box the Compass.—To call over all the points of a compass in regular order. To understand the compass points and subdivisions. (See "Compass.")

Braces.—Gunmetal or brass straps with eyes, fastened to the sternpost to receive the pintles of the rudder.

Strengthening pieces of iron or wood to bind together weak places in a vessel.

Ropes used in working the yards of a ship.

Braced Sharp Up.—Said of a square-rigged ship when the weather braces are slacked up and the lee ones hauled in taut so as to trim the sails as close to wind as possible.

Brace-up and Haul aft!—The order to trim sails after a vessel has been hove to.

Brails. Ropes fast to the leeches of fore-and-aft sails and leading through blocks on the mast hoops; used to haul or truss the sail up to the mast instead of lowering it and stowing it.

Breach.—A breaking in of the sea. A clean breach is when a wave pours over a vessel in solid form, and sometimes makes a clean sweep of the deck, taking crew, boats, and everything else overboard.

Break Aboard.—When the crest of a wave falls aboard on the deck of a vessel.

Breakers.—Casks for containing water. Also the disturbed water over reefs, rocks, shoals, &c.

Break Off.—In close-hauled sailing, when the wind comes more from ahead so as to cause the vessel's head to break to leeward of the course she had been sailing. Not to be confused with "fall off," which means that the vessel's head goes off farther away from the wind.

Break tacks.—When a vessel goes from one tack to the other.

Breaming.—Cleaning off a ship's bottom by burning the excrescences thereon.

Breast Fast.—A warp fastened to a vessel amidships to hold her.

Breasthook.—A strong > shaped knee used forward to bind the stem, shelf, and frame of a vessel together. Breasthooks are also used in other parts of a vessel. They are now frequently made of wrought iron.

Breeze, A.—A strong blow of wind; generally a wind of no particular strength, as light breeze, gentle breeze, moderate breeze, strong breeze, &c. (See "Wind.")

Breeze-up.—The wind is said to "breeze-up" when it increases fast in strength from a light wind.

Bridles.—The parts of moorings to hold on by; many ropes gathered into one.

Brig.—A two-masted vessel, square-rigged on both masts.

Brigantine.—A two-masted vessel, differing from a brig by being only square-rigged forward.

Bring To, or Bring Her To.—To luff. (See "Come To.")

Bring to Wind.—To luff a vessel close to the wind after she has been sailing off the wind.

Bring Up.—To anchor.

Bring Up.—To come to anchor.

Bring Up all Standing.—To come to anchor, or to a stop suddenly without notice, or without any sail being lowered. To anchor without lowering sail.

Bristol Fashion.—In the best manner possible, Bristol shipbuilding and seamen formerly having a great reputation for excellence.

Broach To.—To come to against the wind and helm. (See page 263.)

Broad Pennant.—The swallow-tail flag of a commodore. (See "Burgee.")

Broadside On.—When a vessel moves sideways, or when she is approached by an object at right angles to her broadside.

Broken Water.—When waves lose their form by breaking over reefs, rocks, or shallows, or by meeting a cross sea.

Broom at the Masthead.—A signal that a boat or vessel is for sale. The origin of the custom appears to be unknown; but it is ingeniously argued that brooms were hoisted as a signal that a man wanted to make a clean sweep of his vessel.

Brought To.—After a vessel has been sailing off a wind when she is brought to wind, or close to wind.

Brought Up.—At anchor.

Bucklers.—Blocks of wood used to stop the hawse pipes.

Builder's Certificate.—A document given by the builder of a vessel to the owner when she is handed over, setting forth the builder's name, the name of the ship, place of building, manner of building, rig, dimensions, tonnage, N.M., and concluding with the following declaration:—"This is to certify that [I or we] have built at ———, in the county of ———, in the year ——, the vessel ———. The measurement, tonnage, and description of which are given above.

As witness my hand, this day of ———.

Signed,

This document must be produced when application is made for registration.

Bulk.—(See p. 9.)

Bulkheads.—The partitions which separate a vessel into compartments, cabins, &c.

Bull's Eye.—A block without a sheave, and with one hole in it.

Bulwark.—The side of a vessel above the deck.

Bumboat.—A boat used by shore people to carry provisions on sale to ships.

Bumpkin.—(See "Boomkin.")

Bunk.—A bed or place to sleep in in a cabin.

Bunt.—The middle part of a sail. To gather up the bunt is take hold of the middle part of a sail and gather it up.

Bunting.—Woollen stuff of which flags are made.

Bunter.—A kind of tackle.

Bunt Lines.—Ropes attached to sails to haul them up by.

Buoy.—A floating mark.

Buoyancy.—(See page 3).

Burden or Burthen.—Supposed to mean the quantity in tons of dead weight that a vessel will carry. The quantity would be the difference between the displacement of the ship when light and the displacement of the ship when she was laden as deeply as prudent. (See page 3.)

Burgee.—A triangular flag flown at the truck as a kind of pennant. A commodore's pennant is a "swallow-tail" burgee. A vice-commodore's burgee has one white ball in the upper corner or canton of the hoist; a rear-commodore's, two balls.

Burgee, Etiquette of.—It is considered etiquette, if a yacht is on a station where there is a club established, and her owner is a member of the club, that the flag of that particular club should be hoisted as the yacht arrives on the station, although the owner may be the commodore, or vice, or rear-commodore of another club. If his yacht is a schooner, he can fly his pennant at the main, and the club burgee at the fore. If several yachts are lying at an anchorage where there is no club, the yachts will fly the burgee of the senior officer present; but if there be two officers of equal rank present, then the flag of the one whose club is senior by virtue of the date of its Admiralty warrant will be flown. In the Royal Navy, if two or three ships are cruising in company, the title of commodore is given by courtesy to the senior captain present; but the rank does not seem very well defined, as, although an "appointed" commodore is said to rank next to a rear-admiral, yet he cannot fly his broad pennant in the presence of a "superior captain" without permission. In the case of the Yacht Navy, the senior officer would mean the one of highest rank; and where the rank is equal, seniority depends upon the date of the Admiralty warrant of the club which conferred the rank, and not upon the length of service of the officer; but a vice-commodore of a senior club does not take precedence of a commodore of a junior club. By the same rule, when several yachts are present belonging to clubs that have no Admiralty warrants, the date of the establishment of the several clubs would decide the seniority of officers of equal rank, but clubs with Admiralty warrants always rank before those without. (See "Saluting," "Recognised Clubs," "Royal Clubs," "Admiralty Warrants," and "Ensigns.")

When the Royal Yacht Squadron was first established, members flew private signal flags, containing their crest or other device, at the truck. Owners of schooners in America fly such a flag at the fore when the owner is on board, club burgee always at the main. During meals American yachtsmen sometimes hoist a "dinner napkin," *i.e.*, a square white flag at the fore. The Cambria in the Atlantic race flew her racing flag at the main, and the Royal Harwich Club burgee at the fore.

Burton.—A tackle composed of two single blocks; a double Spanish burton consists of two single and one double block.

Butcher's Cleaver Plate.—This plate has been devised to get a greater area of board immersed without increasing its extreme dimensions, and thereby necessarily increasing the size of the case inside the boat. The plate, instead of being pivoted at its fore end as usual, had an iron bar some two or three feet long riveted thereon; and the plate was then pivoted on this bar.

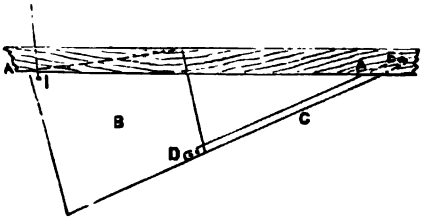


Fig. 101.

A is a portion of the keel of a boat 15ft. long.

B is the plate made of ⅜in. boiler iron 3ft. 6in. long, and 1ft. 4in. deep.

C is an iron bar 1¼in. by ¼in. riveted to the plate at D, and pivoted in the keel at E. The bar at D has "ears" or jaws, into which the plate is fitted and riveted.

The plate is lifted by a jointed bar bolted at I.

When the board is lifted the bar C fits into a groove made in the keel to receive it.

The probability is, as nearly half of the plate would be moving in disturbed water, that equally good results would be obtained from a triangular plate of half the area. It was pointed out on page 15 that the effective lateral resistance for any given plane would be considerably increased if one edge of the plane made a large angle with the direction of its motion; and for this reason a square plate of 3 square feet area would be not much more effective than a triangular one of 1½ square feet area.

Butt.—The joining or meeting of two pieces of wood end-ways. Butt and butt means that two planks meet by their ends, but do not overlap.

Butt End.—The biggest end of a spar.

Buttock.—The after-part of a vessel from her run upwards. Buttock lines or planes in a fore-and-aft direction, showing the outline of vertical fore-and-aft sections in the after-body.

By and Large.—Backing and filling, which see also "Large."

By the Head.—When the vessel is trimmed or depressed by the head so that her proper line of flotation is departed from.

By the Lee.—To bring a vessel by the lee is when nearly before the wind she falls off so much as to bring the wind on the other quarter; or the wind may shift from one quarter of the vessel to the other without the vessel altering her course ("See Lee"). (See page 263.)

By the Stern.—The contrary to being by the head.

By the Wind.—Close hauled; hauled by the wind.

C.

Cable.—A rope or chain by which a vessel is held at anchor.

Cable's Length.—A measure of one-tenth of a sea mile, 607·56 feet, or 101 fathoms, or 203 yards.

Caboose.—The cooking room or kitchen of a merchantman.

Cage Buoy.—A buoy with an iron framework upon the top. Formerly "cages" were put on poles in intricate channels, and for two hours about the time of high water at night fires were lighted in them.

Call.—(See "Boatswain.")

Callipers.—An instrument consisting of a beam with two legs, used for measuring the breadth of yachts, packages of merchandise, &c. Iron bow-legged compasses called callipers are used for measuring the diameter of spars.

Cambered.—When the keel of a vessel has its ends lower than its middle, thus ⌒. Opposed to rockered. (See pp. 16 and 17.)

Canoe Hatch.—The double lines *c c c* are carlines, supposed to be seen through the hatch which is screwed to the two *dotted* ones; the ends of the latter are made to slide in a groove in the combings. The middle carline is fastened to the deck and prevents the latter sliding too far, and stops the water getting into the well should any find its way under the hatch carline. A channel should be made round the rim of the well so that the person sitting therein could fit an apron or waterproof into it after the fashion of the Esquimaux.

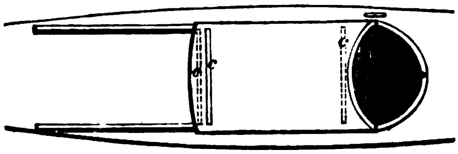


FIG. 102.

A preferable plan is to have the hatch and the frame on which it slides separate, so that it will fit over the rabbets round the coamings; then if the canoe upsets, the hatch will float off and free the canoeist.

Cant Frames.—The frame in the bow and quarter of a vessel that are not square to the keel.

Canvas-back Duck.—A wild duck common in America, and highly esteemed for the table.

Canvas Boats.—These are boats made of canvas, and used by the Galway fishermen, particularly at Dingle. The ribs of the boats are made of wood hoop, such as may be got off casks; outside the ribs battens are nailed in a fore-and-aft direction; a keel to which the ribs are also nailed is rounded up at the ends to form stem and stern post. The canvas is about two feet wide, and runs fore-and-aft. There is an inwale and gunwale as usual at the top of the ribs, the canvas going between the two. These boats are usually 20ft. by 4ft. They are very light, one man carrying them easily. They are manned by a crew of four, each man using a pair of oars. A lug sail is carried off the wind. These boats get through a great deal of rough water by aid of the eight oars they are propelled by.

The following directions for making canvas boats appeared in the *Field*:—

"For the keel get a piece of larch 15ft. long, 2½in. wide, and 2in. deep; the stem and stern posts, with rake according to fancy, may be mortised into the keel; these pieces must be bevelled off from the width of the keel, so as to have a cutwater of about half an inch, which will be sharp enough. Next get three good heavy blocks of wood, and lay them four feet apart in the place where you are going to build your boat; then take the keel with the stem and stern posts already in, and fix it perfectly true on the said blocks, using a spirit level for the purpose. The easiest temporary way of fastening the keel down is to nail short pieces of wood firmly to the blocks, just wide enough apart for the keel to jam between them, and drive a small nail through these pieces into the keel on each side; this will keep all firm, and prevent the keel from moving or twisting as you proceed with other work; it is an important point, and must not be omitted. This done, the next thing is to get a good stout spar, about 2in. or 3in. square, and longer than the boat; tack this on the top of the stem and stern posts; as it is necessary that this fore-and-aft piece should be stayed stiffly in its position, this can easily be done by tacking some rough pieces to it here and there, and nailing the other ends to the rafters of your shed. The uses of this spar are many and obvious. You will thus get your stem and stern posts true, and it will be useful afterwards to keep the moulds in their places, and for shoring out the timbers and ribands or battens so as to keep them shapely to the eye as the work proceeds. Your next business is to make what shipwrights call "the moulds," which is to give the shape, beam, and depth. To make the moulds, first strike it out full size with a piece of chalk on the floor of some room. For a boat 15ft. in length, the width ought to be at least 4ft., the depth not less than 2ft. Do not let the curve of the sides be too sharp, but give her a good round side and a flattish bottom. Having made your moulds to the exact shape of the pattern chalked on the floor, nail a thin strip of wood across the upper (gunwale) ends, which will keep them stiff and true; next take the moulds and nail them on the keel in their proper places, fastening it above to the fore-and-aft piece. The moulds being now firmly fixed in their places, you may proceed to what in other boats would be called the planking. Saw out some thin strips of larch, about 20ft. long, 1in. wide, and a quarter of an inch thick. Six of these on each side would be sufficient. Having chamfered off a little from one of the ends to make it fit the stem of the boat, fasten it with two small copper nails; carry the ribband in your hand, and humour it gently round the moulds tacking it slightly there, and bring it on to the sternpost. You will probably find your piece too long; mark the required length, cut, and nail it in its place. In laying on these ribbands you must begin at the bottom of the boat, and work up. Having fixed your ribband both sides, get two long pieces the same width, only double the thickness, for gunwales, and fix them; fit a breast hook stem and stern, and rivet the gunwales securely to them. Saw out a lot of thin stuff for ribs, half an inch wide, and about the eighth of an inch thick; they will bend easily, and will not require steaming. Put these on about six inches apart, and rivet them to the battens. Next put in your thwarts, fixing them well down in the bottom of the boat, which will make her safer, the weight being near the keel. Get some copper, galvanised iron, or oak knees, with one leg long enough to reach from the gunwale down to the seat; rivet this well to the battens and gunwale, and nail the other part on the seat; there should be four to each thwart, as they help to strengthen the boat immensely. You may now take your boat off the stocks, and she will be ready for the next operation. Get some good new sail canvas, not too stout, and cover one side at a time; tack the edge of the canvas all along the bottom of the keel and pull it to the shape of the boat, tacking it neatly to the sides of the stem and stern posts. Where you find it does not sit well, you may sometimes avoid cutting by folding the spare stuff, and, with a sailor's needle and palm, sew it to the main body of the canvas. Do this on a warm day, as the canvas will then be quite supple, and more easy to handle. Nail a strip of wood half an inch thick on the bottom of the keel to keep all snug, and as an extra security drive a row of tacks through the canvas on each side of the keel. You must be careful to nail over the canvas some narrow strips of wood, as 'bilge pieces,' where you see she would take the ground when lying on her side, otherwise the pulling and dragging over the sand in launching, &c., would quickly wear the canvas through. With care, and with an extra coat of paint now and then, a boat of this sort will last nine or ten years.

"The following suggestions will be found effective to prevent the puckering of the canvas skin of the proposed boat. A framework of 4ft. beam will require about three breadths of canvas on each side, and waste should be avoided by preparing paper patterns by which to cut out the canvas. To do this cut some old newspapers to the width of the canvas, and paste sufficient pieces together end to end to give the required length of the boat. Turn the frame of the boat upside down, and stay it in a horizontal position and upright. Lay the edge of the paper on the flat keel along the middle, place weights upon it, and measure off the distances from the middle line across the paper on the ribs, so as to keep the breadths horizontal from the middle to the stern and bow of the boat. Towards the bow and stern the breadths will be of course materially reduced. Remove the paper on to the floor, and draw a line from point to point marked on the paper at the crossings of the timbers. From this pattern you can easily cut out the two canvas strakes, one for each side of the boat against the keel, which are called the garboards. Replace the pattern; but, before doing so, mark the lower edge for the second breadth of paper, and, setting off the distances along the ribs to the width of the first pattern, you will be able to mark it out and cut it as the previous one. A double seam will be better than a single, as it will give great additional strength to the canvas, and the width of an inch and an eighth should be allowed for it. The lower edge of the third breadth can now be marked and cut out by the upper edge of the second, and if found to reach the gunwale, the top edge may be left uncut until the canvas is drawn over the framework. In applying the canvas to the keel, put plenty of thick paint on the inside to half the breadth of the keel, and nail the selvedge with copper tacks along the middle line; then screw on with brass screws, at 6-inch intervals, a piece of elm plank $\frac{3}{8}$ths of an inch thick, and exactly the same width and length as the keel. Between the 6-inch intervals drive copper tacks. A small strip of copper at the fore foot and heel will prevent this shoeing, as it is called, from catching in anything. To make a good finish at stem and stern, cut out the thickness of the stem and sternpost to the eighth of an inch from top to bottom, as in an ordinary boat, which will form a groove or rabbet, and when you come to this part fold the end of the canvas back. This will give additional strength for the nails, and at the same time make a very snug finish."

"A diagonal-framed canvas boat was built as long ago as 1844, and is still in existence. The canvas was stout, and it was very thickly painted when dry, and not wetted, as is frequently the case, to prevent the absorption of paint. The boat was built on three moulds, the transom or stern board (for she is not canoe-formed at the stern) being one mould, the midship mould the second, and a third equi-distant between it and the bow. An inner keel or kelson having been connected with the stem and sternposts by mortices, this kelson was let into the moulds its own thickness, 1in., and secured. The moulds were steadied in their positions by the gunwales, of ½in. by 2in. yellow pine, nailed to the stern and transom board. The frame of yellow pine, $\frac{3}{16}$in. by ⅞in., was then nailed on diagonally, leaving openings of 2½in. wide where crossing each other. The canvas, put on lengthways, was cut so as to run along the framework parallel with the kelson on each side; and the seams were sewn double, as sails are ordinarily made by sailmakers. There is one bottom and two side breadths, and, therefore, no join along the kelson. The canvas turns in over the gunwale, and is secured by a strip of the same wood. The framework is nailed with copper tacks. The canvas, being so well supported, is perfectly rigid, and the boat appears likely to last a number of years."

Cap.—(See page 91, 93, 94.)

Capful of Wind.—A puff of wind soon passing away.

Capstan.—A mechanical contrivance for raising the anchor.

Capstan Bar.—Bars of wood by which the capstan is turned, and so made to wind up the anchor or raise any weight.

Capstan for a Trawl.—A capstan for a trawl for a yacht of twenty or more tons is made at the Mount's Bay Foundry, Cornwall.

Card.—The dial of a compass upon which the points are marked.

Cardinal Points.—The compass points, E., W., N., and S.

Careen.—To heel, to list, to lean over.

Carlines. — Pieces of timber fitted between the deck beams in a fore-and-aft direction.

Carry Away.—The breakage of a spar, rope, &c.

Carry Canvas. A vessel is said to carry her canvas well if she does not heel much in strong breezes.

Carvel Built.—Built with the plank flush edge to edge, and the seams caulked and payed.

Cast.—Said of a ship when she fills on one tack or the other after being head to wind. Used generally in getting under way, as cast to port, &c. (see page 242). To cast anchor, to cast off a rope.

Catamaran.—A small raft common in the East Indies.

Cat Block.—The block used in catting the anchor.

Cat Boat.—A boat with one sail. (See page 171.)

Catch a Turn.—To take a turn quickly with a rope round a belaying pin, or bitt, or cavel.

Cathead.—Timber or iron projection from the bow of a vessel by which the anchor is hoisted up, after it has been weighed, to the hawse pipe.

Catspaws.—In calms, when the water is rippled here and there with passing airs of wind, it is said to be scratched by catspaws.

Caulking.—(See "Marine Glue.")

Caulking Iron.—A kind of blunt chisel used for driving oakum into the seams.

Caustic Soda.—A mixture of three-parts of soda to two of unslacked lime boiled together and applied hot. In applying it great care should be exercised so as not to allow it to touch the hands. A brush of vegetable fibre should be used, as the composition will destroy hair. Caustic soda is used for cleaning off old paint or varnish; the mixture should be put on nine or ten hours before it is scraped off if a very clean job is desired. If it is a deck that has to be cleaned it is desirable to damp it with fresh water before an application of the mixture; hence it is a good plan to apply it on a dewy morning. Mahogany should be scraped, and not cleaned with caustic soda.

Cavel (sometimes spelt "kavel" or "kevel).""—Stout pieces of timber fixed horizontally to the stanchions on bitts for belaying ropes to.

Ceiling.—The inside planking of a vessel.

Centre-board (a Temporary).—Make a board of the shape of either of those shown in the sketch about one-third of the length of the boat. Three bolts will be on the upper edge of the board; the centre bolt will have a thread longer than the other two, and protrude through the keel. When the board is fitted under the keel, it will be held tight to the keel by a thumb nut on the centre bolt. To unship the board when afloat unscrew the

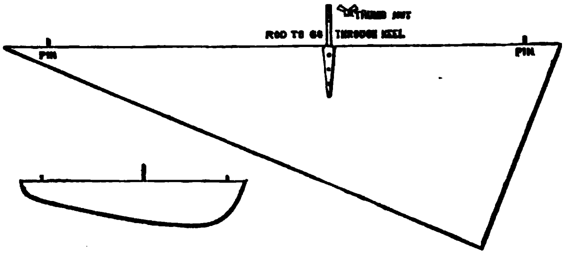
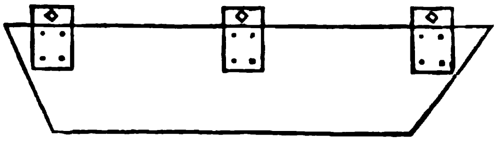


Fig. 103.

thumb nut, push the board down, and it will float up alongside. A cork will be put into the bolt hole. Of course the board cannot be shifted when the boat is afloat. It would be unsafe to sail about in shallow water with such a contrivance; nor should the boat under any circumstances be allowed to take the ground with the board fixed.

Another form of temporary board has been fitted to an ordinary boat, 18ft. long. It consists of a board, to which are affixed iron clamps on either side, which admit of the main keel being inserted between them; through these are passed bolts with nuts, which firmly hold the two keels together.



The dimensions for an 18ft. boat are 6ft. long, 1ft. 10in. deep, and 1½in. thick. The board is to be about 1ft. 6in. shorter on its under side than on its top side, the fore end sloping aft, and the aft end sloping forward; but the slope at the fore end is nearly double that at the aft end.

Place the centre of the keel a trifle in advance of the centre of the main keel; it can be fixed in five minutes when the boat is in the davits; only one word of caution is necessary, that is, not to tow her with the keel on behind the yacht when sailing, or in all probability she will take a sheer out and capsize.

This plan was introduced by Mr. G. H. Harrison, of the Siesta schooner; but it is not quite so good as the American plan on the other page, because it cannot be unfitted or released whilst the boat is afloat.

Chain Pipe.—Iron pipe on the deck through which the cables pass into the lockers.

Chain Plates.—Iron braces on the side of a ship which sustain the rigging.

Channel Plates.—(See "Chain Plates.")

Channels.—Strong pieces of timber fixed on the side of a ship inside the chain plates to give greater spread to the rigging.

Check, To.—To check a sheet is to ease it a little. To check a vessel's way by a warp, or by backing a sail. To check a tide is to keep a vessel from her course, in order to allow for the influence or drift of a tide. To check a vessel with the helm is to prevent her altering her course. (See "To Meet.")

Cheek Blocks.—A sheave fitted on a spar inside a sort of cleat, as the cheek block for topsail sheet on the end of a gaff. (See page 90).

Cheeks of the Mast.—The hounds.

Cheering.—The "hip, hip, hurrahs!" that the crew of a vanquished yacht greets the victrix with. A custom much honoured. (See "Man Ship.")

Chill.—In very light winds, if a cloud passes overhead and a puff comes out of it, it is called a chill—probably on account of its coldness.

Chinese Lug.—(See page 104.)

Chips.—A nickname for a ship's carpenter.

Chock.—A block or wedge of wood.

Chock a Block.—Said of two blocks when, in hoisting or hauling, the two blocks of a tackle are brought close together. Generally when two things are brought so close together that they cannot be got closer.

Chock Full.—Full to the brim. Frequently used in close-hauled sailing to let the helmsman know that the sails are full enough, and he need keep her no more off the wind.

Chock Home.—Close up.

Chopping Sea.—A short, steep sea, which makes a vessel continuously pitch and 'scend.

Chuckle-headed.—Full or bluff in the bow; thick-headed.

Chuck to Windward.—A weather-going tide is said to chuck a vessel to windward, and the contrary a lee-going tide.

Circumference of a Circle.—The diameter multiplied by 3·14159.

Clamp.—A thick strake of wood worked inside a vessel under the shelf. (See pp. 81, 82).

Clamps.—A kind of wedge vice, used in boat-building to hold the plank together. (See Fig. 95, page 327.)

Clamps.—Various contrivances of wood or metal used in fitting up a vessel or in fixing parts in her construction.

Clap on Canvas.—To put on more canvas. "Clap on here" is a request frequently made to idlers to assist in hauling in a rope.

Claw.—To hang well to windward, as to "claw off a lee shore."

Claw to Windward.—To beat to windward under difficulties. To claw off a lee shore is to beat off and avoid getting stranded.

Clean Full.—Barely close-hauled; when all the sails are full.

Clear for Going About.—A question often asked when work is being done on deck, and the vessel has to be put about: "Are ye all clear there for going about?"

Cleats.—Pieces of wood with one or more arms fastened to spars, &c., for belaying to, or to prevent ropes slipping, &c. (See "Cruickshanks' Patent Safety Cleats.")

Clench Work (spelt also "clencher," "clincher," and sometimes "clinker.")—In boat building when the edges of the plank overlap, forming lands.

Clew.—The lower corners of a square sail; in fore-and-aft sails only the lower after corner is called the clew.

Clew Lines.—Clew garnets. Ropes used for hauling up the clews of sails. (See page 91.)

Clinch.—To fasten a rope by a half hitch, and seize the end back to the other part; a method adopted with very large ropes or hawsers when they have to be bent to rings, &c., in a hurry.

To clinch is also to beat the end of a bolt or rivet until it forms a head.

Clinometer.—An instrument for measuring the angle of inclination or the extent of heel a ship has under canvas or whilst rolling.

Clip Hook.—A hook with overlapping parts.

Clipper.—A fine ship; first applied to the sharp-bowed ships that sailed out of Baltimore, U.S.

Clock Calm.—So calm and still that the ticking of a clock could be heard.

Close Aboard.—Near to, as the land is said to be close aboard when a vessel has approached it very closely.

Close-hauled.—With all the sheets trimmed flat aft, and every rope that helps extend the sails hauled taut. Hauled as close to the wind as the sails will admit without shaking their luffs. (See pp. 22, 23, &c.) When a square-rigged ship is close-hauled she is about six points off the wind. A fore-and-aft schooner, with everything nicely trimmed for racing, will lie within four and a half points of the wind; a cutter within four and a quarter points. This, of course, supposes the water to be smooth and the wind of what is known as "wholesail strength." In rough water a vessel cannot be sailed so close; in the Atlantic race between the Cambria and Dauntless, the former, although she had head winds for a large part of the time, was never hauled up closer than six points, for two reasons: generally there was too much sea to admit of it, and in such long passages it was thought best to sail her along hard on the chance of the wind freeing; or if it headed her she could have been put on the other tack. (See "Wind.")

Close Reefed.—When the last reef is taken in, generally the fourth reef; but some modern schooners with laced mainsails have only three reef bands, and it is thought that when the fourth reef is wanted that it is time to set the trysail.

Close to Wind.—Close hauled. As close as the sails will bear without lifting.

Clothes.—The outfit given to a yacht's crew by the owner, consisting of trousers, frocks, caps, shoes, and neckerchief. When the yacht is paid off the men take the clothes with them, but if a man is discharged for misconduct, he is made leave his clothes behind. Under any circumstances the men have no legal right to the clothes if the owner chose to retain them, as it is only a kind of livery.

Clothes Lines.—A sail is said to be across a clothes lines when it is girted by a rope. Lines used on board men-of-war for drying the sailors' clothes on washing days.

Cloth in the Wind, A.—When the foremost cloth or luff of a sail is shaking through the vessel being brought too near the wind.

Clove Hitch.—(See "Scowing an Anchor.")

Club Hauling.—(See page 249.)

Coal, Consumption of.—With engines of the old type a steamer consumed from 4lb. to 6lb. of coal per indicated horse-power per hour. With compound engines the consumption is from 2lb. to 3lb. per horse-power per hour.

Coamings.—A raised frame fitted to and above the deck for the hatches, skylights, &c., to rest upon.

Coats.—Painted canvas used to cover sails when they are stowed.

Coble.—A boat common on the Yorkshire coast. Said to run over a sea very dry. The peculiar deep rudder makes them steer well in a sea.

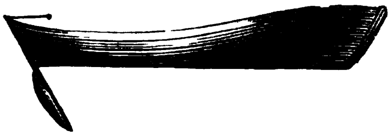


FIG. 105.

Cockpit.—In a man-of-war, part of the ship below water where the middies were berthed, and where the wounded were attended in time of action. A kind of well in the deck aft, common in American yachts and in some small ones in this country.

Coil.—Ropes packed up in rings one over the other.

Cole's Anchors.—(See "Anchors.")

Collar.—An eye or bight of a shroud, stay or rope to go over the masthead as the collar of the forestay. Also a rim on a bolt.

Collier.—A vessel employed to carry coal.

Collision.—When one vessel comes into contact with another.

Colours.—Flags denoting nationality, ownership, or other identity.

Comber.—A big surf like wave.

Combings.—(See "Coamings.")

Come no Nearer.—An order to the helmsman not to bring the vessel nearer the wind.

Come on Board, Sir.—A seaman's way of reporting his arrival on board to an officer in charge.

Come To.—To fly up in the wind; to come nearer or closer to the wind; to luff. Generally used when a vessel comes nearer the wind after having falling off the wind.

Come Up.—Generally to slack up. Whilst hauling on the fall of a tackle and the order comes, "Avast hauling there," the hand that has to belay sings out, "Come up behind;" all hands instantly release the fall, so that the one who has to belay can catch the turn round the belaying pin or cavel without "losing any." (See "Hold on the Fore Side" and "Belay.")

Come Up.—A vessel is said to come up when the wind frees her so that she can head nearer her course, or look or point her course. In beating, a helmsman in reporting the progress made by the vessel may say, "She has come up two points this tack, sir," according to the extent of the wind freeing; if the wind came more ahead, he might say she has broken off or fallen off two points, &c.

Come up With.—To overtake.

Commodore.—A rank conferred by clubs upon members; and there are Commodores, Vice-Commodores, and Rear-Commodores. Their duties are to see that the laws of the club, especially those that apply to matters afloat, are properly carried out. Commodores fly the broad pennant or swallow-tail burgee. (See "Burgee.")

Companion.—The entrance from the deck to the below cabins.

Compass Bowl.—The bowl containing the compass within the binnacle.

Compass Card.—A circle divided into 32 parts, called points; and each part is again divided into 4 parts, and the whole is divided into 360 degrees.

Courses.	Degrees.			Points.	Back Bearings.
	°	′	″		
N.	0	0	0	0 point	S.
N. ¼ E.	2	48	45	¼ ,,	S. ¼ W.
N. ½ E.	5	37	30	½ ,,	S. ½ W.
N. ¾ E.	8	26	15	¾ ,,	S. ¾ W.
N. by E.	11	15	0	1 point	S. by W.
N. by E. ¼ E.	14	3	45	¼ ,,	S. by W. ¼ W.
N. by E. ½ E.	16	52	30	½ ,,	S. by W. ½ W.
N. by E. ¾ E.	19	41	15	¾ ,,	S. by W. ¾ W.
N.N.E.	22	30	0	2 points	S.S.W.
N.E. by N. ¾ N.*	25	18	45	¼ ,,	S.W. by S. ¾ S.
N.E. by N. ½ N.	28	7	80	½ ,,	S.W. by S. ½ S.
N.E. by N. ¼ N.	30	56	15	¾ ,,	S.W. by S. ¼ S.
N.E. by N.	33	45	0	3 points	S.W. by S.
N.E. ¾ N.	36	33	45	¼ ,,	S W. ¾ S.
N.E. ½ N.	39	22	30	½ ,,	S.W. ½ S.
N.E. ¼ N.	42	11	15	¾ ,,	S.W. ¼ S.
N.E.	45	0	0	4 points	S.W.
N.E. ¼ E.	47	48	45	¼ ,,	S.W. ¼ W.
N.E. ½ E.	50	37	30	½ ,,	S.W. ½ W.
N.E. ¾ E.	53	26	15	¾ ,,	S.W. ¾ W.
N.E. by E.	56	15	0	5 points	S.W. by W.
N.E. by E. ¼ E.	59	3	45	¼ ,,	S.W. by W. ¼ W.
N.E. by E. ½ E.	61	52	30	½ ,,	S.W. by W. ½ W.
N.E. by E. ¾ E.	64	41	15	¾ ,,	S.W. by W. ¾ W.
E.N.E.	67	30	0	6 points	W.S.W.
E. by N. ¾ N.	70	18	45	¼ ,,	W. by S. ¾ S.
E. by N. ½ N.	73	7	30	½ ,,	W. by S. ½ S.
E. by N. ¼ N.	75	56	15	¾ ,,	W. by S. ¼ S.
E. by N.	78	45	0	7 points	W. by S.
E. ¾ N.	81	33	45	¼ ,,	W. ¾ S.
E. ½ N.	84	22	30	½ ,,	W. ½ S.
E. ¼ N.	87	11	15	¾ ,,	W. ¼ S.
E.	90	0	0	8 points	W.
E. by S., and so on.	92	48	45	¼ ,,	W. by N.

* It is customary in the Royal Navy to call this N.N.E. ¼ E.; N.N.E. ½ E.; N.N.E. ¾ E., then N.E. by N. Either way is correct. Sometimes also E. by N. ¾ N. is called E.N.E. ¼ E.: or N.E. by E. ¾ E. is called for shortness E.N.E. ¼ N. The table, however, gives the more correct way. In calling off the points avoid such "lubberisms" as N.E. by E. ¾ N. for N.E. ¼ E., or S. by W. ¾ S. for S. ¼ W., &c.

Compass Point.—The 32nd part of 360 degrees, or practically 11¼ degrees.

Complement.—The full number; the whole ship's crew.

Composition for a Boat's Bottom.—Day's composition has been much used for coating the bottom of boats. It is said to prevent the growth of weeds, barnacles, &c. The boat should have a coat of common varnish first, and the composition should be applied before the varnish is quite dry. Only a part of the boat should be varnished at a time, or the varnish will dry before the composition can be put on. One gallon carefully put on will cover about 400 square feet or the immersed surface of a 10-tonner. The composition should be kept well stirred whilst being used, as the ingredients are heavy, and soon settle to the bottom. Day's address is Forest Hill, London. (See "Jesty's Composition.")

Compressor.—A contrivance to prevent the chain cable being veered too quickly, or to stop its veering altogether.

Conduct Money.—Money kept back from a seaman's wages, but given up in whole at the end of an engagement if the seaman's conduct has been good; generally the amount kept back is 2*s*. per week, and a fine to that amount is levied for an offence. (See page 284.)

Contrary Wind.—A wind that blows adversely down a vessel's course.

Copper Bottomed.—The bottom of a ship sheathed with copper.

Copper Fastened.—Fastened with copper bolts and nails.

Coracle.—A small boat used by the ancient Britons.

Cordage.—A general term used to denote the rope used in the rigging of a ship.

Corinthian.—A term in yacht parlance synonymous with amateur. The term Corinthian half a century ago was commonly applied to the aristocratic patrons of sports, some of which, such as pugilism, are not now the fashion. No doubt the name originated with the supposed similarity between the fast young men of the Greek Empire who emulated the feats of athletes, &c., and their modern prototypes.

A "Corinthian" sailor has never been defined, but a club rather arbitrarily a year or two ago decided that a yacht builder was not an amateur sailor. The Royal Alfred Yacht Club, which promotes amateur seamanship, enjoins that in all matches the amateur element shall consist of "members of the club, their sons, or members of a royal, foreign, or recognised yacht club." No other club, so far as we know, has made any such stipulation as this. Some clubs only allow yachts of 15 tons and under one paid hand, who is not permitted to touch the tiller A later and more suitable plan is to have paid hands in the proportion set forth in the table, page 287. In all cases an amateur must steer.

Corinthian Rule of Measurement.—A tonnage measurement adopted by the Corinthian Yacht Club on the builder's rule for roughly estimating the register tonnage of a vessel, thus $\frac{L \times B \times D}{200}$, where L length, B breadth, and D depth, amidships from deck to underside of keel. This rule was also adopted by the New Thames Yacht Club in 1875, but after a trial of two years it was abandoned, as the general opinion appeared to be be that the rule would have an injurious influence on yacht designing.

Cot.—(See "Wexford Flat-bottomed Boats.")

Counter.—The projecting part of a vessel aft.

Course.—Direction; the direction in which a vessel moves; the direction from a point to another point which a vessel has to reach. The distance yachts have to sail in a match at a regatta.

Courses.—The lower squaresails of a ship.

Covering Board.—See "Plank sheer."

Coxswain.—The man who steers and has charge of a boat and her crew. (See page 278.)

Crabbing.—When a vessel tumbles down under a heavy press of canvas, or when she sags to leeward badly.

Cracking on.—Carrying a large quantity of sail.

Cracks in a Mast or other Spars, To Stop.—When the spar is quite dry run in marine glue; when the glue is hard, scrape out some of it, and stop with putty, coloured to imitate the colour of the wood.

Craft.—A vessel; also used in the plural, thus a number of craft; or a lot of craft means a number of vessels.

Crank.—Not stiff under canvas; a boat that can be heeled or listed very easily; generally a dangerous boat.

Cranse.—An iron hoop band, with eyes fitted to bowsprit ends or the ends of other spars. (See Fig. 68, page 214),

Creek.—An inlet of the sea.

Crests.—The top edges of waves.

Crew.—A ship's complement, and including every man employed on board in any capacity whatsoever, distinct from passengers.

Crimps.—Agents for engaging seaman: a vocation not in high repute.

Cringle.—A metal thimble worked into the corners and leeches of sails.

Cripple, A.—A vessel that does not carry her canvas stiffly.

Cross Chocks.—Pieces of wood used for filling in between lower futtocks where their heels do not meet on the keel.

Cross Sea.—Waves that come from divers directions, usually caused by sudden shifts of wind when it is blowing heavily.

Cross-trees.—See pp. 90, 91, 92, 93, 94.

Crow-foot.—A number of lines attached to one line, and spreading out something like a bird's claw.

Crown of an Anchor.—The part of an anchor where the arms are joined to the shank.

Crow's Nest.—A place of shelter at the top-gallant mast-head for a look out man, used by whalers in Northern latitudes.

Cruickshank's Patent Cleats.—This is a contrivance for jamming the mainsheet without any turns or bights, so that when a certain pressure is put on the sail the sheet unreeves. The cleat was invented with a view of preventing boats being capsized when struck by sudden squalls. The objection to such cleats is that they may possibly foul, and moreover the pressure which if applied steadily would just cause the sheet to unreeve, might if applied suddenly capsize the boat long before the sheet would run through the jammers. (See page 269.) With a "breeze of wind" there is generally some sea, and then it is not so frequently a sudden accession of wind or squall that causes the boat to capsize as her position among the waves. If she gets so placed as to lurch or roll to leeward from the effect of a wave crest passing underneath her, she may upset without any increase in the pressure of wind; that is to say, if her safe angle of heel under canvas is 20 degrees, and she be permanently heeled by the wind pressure to that angle, then, if the action of the waves caused her to heel further—say 10 degrees—she would capsize unless skilfully handled by the steersman. As there need be no increase of wind pressure to bring about such a catastrophe, the "safety cleat" would be of no avail under such circumstances. In smooth water it would never be prudent or safe to wait for a squall to strike a boat, as, if the squall were heavy enough to cause the boat to heel to the capsizing point, the safety cleat could not relieve the sheet fast enough to prevent such heeling. The squall must be "met," the boat thrown head to wind, and the sheet released, before the squall strikes. Sometimes in small boats, with the wind abeam or abaft the beam, it may be more prudent to run them off the wind; but scarcely in any case, either in a sea or in smooth water, could the safety cleat save a boat from being capsized if the helmsman or crew carelessly handled her when she is in danger of such a catastrophe. Mr. Cruickshank's cleat is provided with a releasing line, which is to be held in the hand, and if the break does not allow the sheet to be released fast enough, the line is to be pulled. Manifestly it would be safer and give less trouble to hold the sheet itself in the hand. (See "Beadon's Safety Reel").

Crutch.—An iron support for a boom when the sail is stowed something in this form Y; the upright part fits into a socket on the taffrail. Crutches are sometimes made of two cross pieces of wood, thus X; in schooners the crutch for the fore boom is generally so formed; also a similar crutch is used to put the tiller in when the vessel is moored to keep it from flying about, and and when by lashing the tiller lines across the vessel to either rail the passage fore and aft would be inconveniently obstructed.

Cuddy.—A small cabin, a deck house, the space under the half deck of a boat.

Cunt-line.—The space between casks when they are stowed bilge to bilge.

Cutter.—A boat heavier than a gig, and used in bad weather when the lighter boat might get swamped.

Cutter.—A vessel with one mast rigged with mainsail, foresail, jib and topsail, as shown in the accompanying sketch, known as the national rig.

A cutter's sails are termed "fore-and-aft" sails, because they are tacked and sheeted in a fore-and-aft direction in contradistinction to sails which are tacked and sheeted as squaresails are.

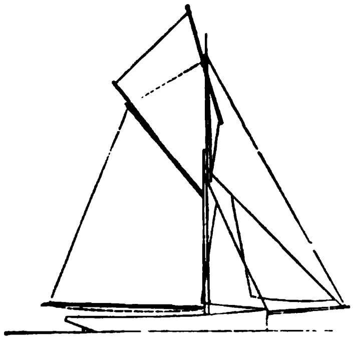


FIG. 106.

D.

Dagger knee.—A piece of timber crossing the frames diagonally.

Dandy.—A cutter rigged vessel with lug mizen aft set on a jigger-mast.

Darning the water.—When a vessel keeps sailing backwards and forwards, as before a bar harbour or pier, waiting for water or orders, &c.

Davit Guys.—The stays or ropes used to keep the davits steady.

Davits.—Strong iron arms used for hoisting boats, &c.

Day's Paint for Ships' Bottoms.—(See "Composition.")

Dead calm. — When there is not a breath of wind.

Deaden-her-way.—To stop a vessel's way by backing and filling, or by hauling a sail aback, &c.

Dead eye.—A circular block, with three holes in it (crow-foot fashion) without sheaves, used to reeve the lanyards through for setting up the rigging (See page 91 to 101).

Dead flat.—The midship section. The term is applied to the middle flat of a ship, where she gets no broader and no narrower; that is, where the cross sections for some distance amidships are of the same size and form: thus the side will present a "dead flat" for some distance (See "Straight of breadth").

Dead Lights.—Strong shutters made to fit the outside of cabin windows—closed in bad weather. In yachts small circular lights are generally fitted, and without the shutters.

Dead on end.—Said of the wind, when it blows straight down the course a vessel wishes to make (See "Nose-ender," "Muzzle").

Dead Reckoning.—The calculation of a ship's position by the log, the courses she has made, lee way, set of currents, &c., without an observation.

Dead Rise.—The approach the floor timbers of a vessel makes to a perpendicular. In the case of ships, the frames in the after body are called the dead-risings, because they only rise from the keel at a sharp angle, all the middle frames starting nearly horizontally from the keel. A yacht is said to have considerable dead rise on a very rising floor, when she is more or less of the V form, but really vessels of the T form have the greatest dead rise, as the heels of the floors forming the framing to take the garboards, do rise nearly perpendicularly to the keel.

Dead water.—The water in a vessel's wake, close to her rudder, that does not appear to move with such rapidity as the water along a ship's side.

Dead weight.—Concentrated weight in a vessel's bottom, such as a heavy cargo, or ballast.

Dead wood.—The solid wood worked on top of the keel forward and aft (See pages 83 and 90).

Deck.—The platforms supported on the beams of ships. The old three deckers had upper deck, main deck, middle deck, lower deck, and orlop deck, no guns being carried on the latter. Below the orlop deck were the hold platforms, or decks. Yachts usually are said to have only one deck, *i.e.* the upper deck open to the sky; some large yachts, however, have a lower deck, laid and caulked. Smaller yachts have platform beams upon which the platform rests. The platform is the floor of the cabins.

Deck Caulking and Stopping.—(See "Marine Glue.")

Deck, to Whiten.—Make a mixture of 1lb. oxalic acid to 1 gallon of water. Damp the deck with this and wash off.

Deep sea lead (pronounced "dipsey lead").—A lead of 28lb. weight attached to a line of 200 fathoms. Now, automatically recording machines are generally used for deep sea soundings. (See "Lead.")

Delivery.—The quarter wash of a vessel. A yacht is said to have a good delivery when on passing through the water no waves are raised at and about the quarters; she is then said to leave the water clean, to have a clean wake, clean delivery, or to run the water very clean aft.

Demurrage.—Compensation paid to the owner of a ship when she has been detained longer than reasonable by a freighter at a port.

Depth of Hold.—In a single-deck vessel, the height between the kelson and deck.

Derelict.—A vessel abandoned at sea. It is said that an owner's rights are not also abandoned if any live animal be left and found on board.

Derrick.—A kind of crane.

Deviation.—A movement of the compass needle due to local attraction, principally met with in iron ships, and distinct from variation.

Dhow.—A large Arab vessel, usually lateen-rigged.

Diagonal Braces.—(See page 71.)

Diagonal lines (See pp. 128, &c.).

Diameter of Circle.—Circumference multiplied by 0·31831.

Diminishing strakes.—The strakes immediately above and below wales being the thickness of the wale on one edge, and diminishing to the thickness of the plank on the other.

Dinghy.—A small boat of Bombay, with a settee sail. Also a small skiff, or punt, carried by yachts. (See "Portable Dinghy.")

Dinghy-man.—The man who has charge of the dinghy of a yacht, whose duty it is to go on shore on errands, &c.

Dip.—The inclination the compass needle makes towards the earth in high latitudes.

Dip the Ensign, To.—To lower the ensign as a salute, or token of respect (See "Dipping the Ensign").

Dipping Lug Sail.—A sail hoisted by a halyard and mast hoop traveller. The sail is set to leeward of the mast and the tack is usually fast to the stem or on the weather bow. In tacking or gybing the sail has to be lowered and the yard shifted to the other side of the mast. A plan has been proposed to perform this dipping by the aid of a topping and tripping line instead of by lowering the sail (see the accompanying sketch); but the balance lug, which requires no dipping whatsoever in tacking, is to be preferred to the best dipping arrangement. (See "Penzance Luggers.")

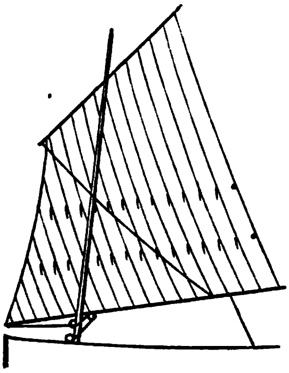


FIG. 107.

Dipping the Ensign.—The ensign is lowered or dipped as a means of saluting a commodore, &c., or member of a club. The junior member should be the first to dip. Sometimes, if no ensign is flying, the burgee is dipped. It is usual to "dip" on passing a man-of-war or royal yacht. A royal yacht never answers the salute by dipping her ensign.

Discharge Ticket.—A formal document given to seamen when they are discharged.

Dismantled.—Unrigged: without sails or spars.

Dismasted.—When a vessel loses her mast by violence, or accident.

Displacement.—(See pp. 3, 5, 135.)

Divisions.—The portions of a fleet; as the starboard, port, and centre divisions, the admiral in command always occupying the centre division. Prior to 1856, there were red, white and blue divisions, but now that only the white St. George's ensign is recognised the divisions by colour have been done away with. (See "Admiral.")

Dock.—A basin into which a ship is floated and the gates closed upon her; the water is then pumped out and the ship left dry, supported on a framework and by shores. These are called dry docks.—A general name for a place to receive ships for repair or cleaning. A ship is said to dock herself when placed in a soft tidal bed of mud she buries herself in it more or less.

Dockyards.—Places where ships are built; usually however confined to government naval works.

Dog Shores.—Pieces of timber used in launching ships.

Dog Vane. A light vane made of bunting or feathers, to show the direction of the wind, and sometimes put on the weather rail.

Dog Watches.—The divided watch between four and eight in the evening; thus the first dog watch is from four to six, and the second from six to eight. (See "Watches.")

Doldrums.—The state of being becalmed. Parts of the ocean where calms are prevalent.

Dolphins.—Stout timbers or stone pillars placed on wharfs to make fast warps to.

Dolphin Striker.—The perpendicular spar under the bowsprit end by which more spread is given to the stay of the jib-boom.

Double-banked.—When men sit on the same thwart to row oars from different sides of a boat.

Double Block.—A block with two sheaves.

Doubling Plank.—To put one thickness of plank over the other.

Douse or Dowse.—To lower away suddenly, to take in a sail suddenly.

Dove-tail Plates.—Plates in form like a dove-tail.

Dowell. A piece of hard wood or kind of plug used for connecting timber on the edges of plank.

Downhaul.—A rope used for hauling sails down.

Down Helm.—An order to put the helm to leeward and cause the vessel to luff.

Down Oars.—The order given for the crew of a boat to let fall their oars after having them on end in the boat.

Down Wind.—Sailing in the direction of or with the wind; before the wind; with the wind astern.

Down Wind, Down Sea.—The sea will subside when the wind does.

Drag.—The increased draught of water aft compared with the draught forward.

Drag, To.—To scrape the bottom; to search the bottom with grapnels.

Draught of Water.—The depth of a vessel to the extreme underside of the keel measured from the load water line.

Draw.—A sail is said to draw when it is filled by the wind. To let draw is to ease up the weather sheet of a sail after it has been hauled to windward, and trim the lee sheet aft.

Draw her to.—An order to bring a vessel closer to wind.

Dress.—To dress ship is to hoist flags from deck to truck; or from bowsprit end to truck and taffrail.

To dress copper is to lay or smooth down wrinkles by going over it with a flat piece of hard wood and a hammer.

Drift.—To float about with the tide or current.

Drift.—The distance between two blocks of a tackle; the distance two parts of a thing are apart.

Drive.—To move by the force of the wind or drive without control.

Dry-rot.—The decay timber is subject to, often through imperfect ventilation.

Duck.—Light canvas of which boat sails and balloon sails are made. To duck is to dive under water.

Ducks.—A sailor's white suit of duck.

Dumb Cleat.—A thumb cleat.

Dump.—A nail used in fastening plank to the timbers.

Dungaree or Dongaree.—A blue linen or cotton cloth in use in India, now much used for the rough or working suits given to yacht sailors.

Dunnage.—Loose material such as cork, bamboo, shavings, ferns, coir, &c., used to jam in between a heavy cargo such as casks, iron, &c.

Dynamometer.—An instrument to measure forces.

E.

Earings.—Ropes used to fasten the corners of the heads of sails to the yards, by the cringles. The upper corners of sails are frequently termed earings. (See "Reef Earings.")

Ears of a Bolt.—A bolt with a score in it, into which another part is fitted and held by a through pin so as to form a joint like that of a gooseneck.

Ease Away.—The order to slacken a rope, &c.; to ease off a sheet, to ease up a sheet, are synonymous terms, and mean to slacken. (See "Check.")

Ease the Helm.—The order given when sailing against a head sea to ease the weather helm, and by luffing meet the sea bow on, and at the same time deaden the ship's way so that the sea and ship meet less violently. Generally to put the helm amidship, or more amidship after it has been put to port or starboard.

Eating a Vessel out of the Wind.—When two vessels are sailing in company, and if one soaks or settles out to windward of the other she is said to eat her out of the wind.

Eating to Windward.—A vessel is said to eat to windward when she apparently soaks out to windward of her wake.

Ebb.—The receding of the tide.

Eddy.—Water or currents of air apparently moving in circles.

Edge Away.—To gradually keep a vessel more off a wind after sailing close hauled.

Edge Down on a Vessel.—To bear away towards a vessel to leeward, so as to approach her in an oblique direction.

End for End.—To shift a spar, rope, &c., by reversing the direction of the ends.

End On.—Said of vessel when she has an object bearing in a line with the keel, directly ahead of the bow. On approaching a mark or buoy it is said to be end on if it is directly ahead of the vessel, the bowsprit will then point to the object, hence it is sometimes said that an object is "right on for the bowsprit end."

Ensign.—A flag flown as a distinguishing mark of nationality. The red ensign with "Union Jack" in the upper corner of the hoist is the English national flag; but the ensign of the Royal Navy is white with red St. George's cross in it besides the Jack in the corner: this is called "St. George's ensign." Prior to 1856 the red (highest in rank) white and blue ensigns were used in the Royal Navy, and there were Admirals of the Red, Admirals of the White, and Admirals of the Blue; and there were Vice and Rear Admirals of the red, white, and blue. A fleet was divided into red, white, and blue divisions, according to the rank of the Admirals who commanded. In 1855 the red ensign was allotted to the British Mercantile Marine, the blue ensign to the Royal Naval Reserve, and the white ensign to the Royal Navy.

In the Royal Navy it is etiquette, when an Admiral is on board his ship to fly the white ensign from the main truck, Vice-Admiral from the fore truck, and Rear-Admiral mizen truck. A Jack is carried at the stem head or bowsprit end (all ships of the Royal Navy now usually so carry a Jack). When a council of war is being held on board a flagship, the white ensign is displayed in the main, fore, or mizen shrouds, according to the rank of the Admiral. If there is to be an execution after a Court Martial, the white ensign is hoisted on the main, fore, or mizen yard arm.

If an ensign other than the red be flown by any vessel without a warrant from the Admiralty, a penalty of 500*l.* may be inflicted, and any Custom House or Consular officer or other officer in H.M.S. on full pay may board the vessel and seize the flag. Although the red ensign has been assigned to the mercantile marine, no device can be put in it other than the Jack without the permission of the Admiralty. The jurisdiction of the Admiralty only extends to flags flown afloat, and any ensign can be hoisted on flagstaffs on shore. When a warrant is granted to a club to fly the white, blue, or the red ensign with a device, this warrant does not of itself entitle a member of the club to fly either ensign on board his yacht; before he can legally do so he must also obtain a warrant from the Admiralty through the club secretary. As many warrants must be obtained as he belongs to clubs if he desires to fly the flag of each club. When the yacht is disposed of, the warrants must be returned through the club secretary to the Admiralty, and if the owner obtains a new yacht he must get fresh warrants.

Prior to 1858 the Royal Western Yacht Club of Ireland flew the white ensign with a wreath of shamrock in it. In 1847, the privilege of flying the white ensign was accorded to the Royal St. George's Yacht Club, Kingstown, but was afterwards rescinded upon a representation by the Royal Yacht Squadron that that club by its warrant of 1829—(prior to 1829, the R.Y.S. flew the red ensign)—had the exclusive privilege of flying the white ensign. In 1853 an application was made in Parliament to know if the R.Y.S. had that exclusive privilege. The first Lord of the Admiralty said it had not, inasmuch as the privilege had also been extended to the Royal Western of Ireland in 1832, and was still enjoyed by that club. In 1858 the Royal St. George's Yacht Club (also the Holyhead) again applied for permission to fly the white ensign; the permission was not granted, and the Admiralty informed the Royal Western that they were no longer to use it; on making search at the Admiralty, it was found that in 1842 a decision was come to restricting the white ensign to the Royal Yacht Squadron; and the clubs affected by the decision were informed of it accordingly, but the Royal Western of Ireland was not interfered with, because up to that time no application for separate warrants from the club for yachts to fly the ensign had been received; and further in 1853, the Royal Western obtained permission to continue to use the ensign. However, in 1858, the Admiralty revoked that permission, and since that date no club excepting the R.Y.S. has been permitted to fly the St. George's ensign. It would be much better if the Admiralty only issued warrants to fly the blue ensign without device, and cancelled all existing warrants that gave permission to put devices in the red ensign. (See "Admiralty Warrants," "Royal and Recognised Clubs," "Burgee.")

Ensign for Hired Transports.—The blue ensign with admiralty anchor (yellow) in the fly.

Ensign, Hoisting of.—Ensigns and burgees are hoisted every morning at eight o'clock (9 a.m. from September 30 to March 31), and hauled down at sunset. It is a slovenly habit to hoist and haul down colours at irregular hours. At sea it is only usual to hoist colours when passing another vessel.

Ensign of the Colonies.—The blue ensign with arms or badge of colony in it.

Ensign of Naval Reserve.—The blue ensign.

Entrance.—The fore part of a vessel, the bow. A good entrance into the water means a long well-formed bow.

Entrance Money.—The money demanded by clubs from yacht owners, who enter their vessels for match sailing at regattas.

Entry.—The record that a yacht is engaged for a particular match.

Equipment.—The complete outfit of a vessel including everything used in her handling, working, and accommodation. The inventory comprises the equipment.

Even Keel.—Said of a vessel when she is not heeled either to port or starboard, also when her keel is horizontal, that is when she is so trimmed that her draught forward is the same as aft.

Every Stitch of Canvas Set.—When all available canvas that will draw is set.

Extreme Breadth.—The greatest breadth of a vessel from the outside to the outside of the plank, wales and doubling planks being included and measured in the breadth.

Eye Bolt.—(See "Bolts.")

Eyelet Holes.—Small holes worked in sails for lacings, &c., to be rove through.

Eyes of her.—The extreme fore end of the ship near the hawse pipes, which are the "eyes of her."

Eyes of the Rigging.—The loops spliced into the ends of shrouds to go over the mast, and dead eyes.

Eye Splice.—The end of a rope turned in so as to form an eye.

F.

Fag End. When there is "nothing left of the rope but the end." The payed-out end of a rope.

Fairing a Drawing.—A process by which the intersections of curved lines with other lines in the body plan, half-breadth plan, and sheer plan are made to correspond. A fair curve is a curved line which has no abrupt or unfair inflexions in it.

Fair Lead.—When the fall of a rope leads fairly, without obstruction, from the sheave hole. A lead made for a rope through a sheave hole or other hole.

Fair Leaders.—Holes in plank, &c., for ropes to lead through, so that they lead fairly and are not nipped or formed into a bight.

Fairway.—The ships' course in a channel. The navigable channel of a harbour as distinct from an anchorage in a harbour. A harbour master's duty is to see that the fairway is kept clear, and that no vessels improperly anchor in it. A fair way is generally buoyed.

Fair Wind.—A wind by which a vessel can proceed on her course without tacking; it may range from close-hauled point to dead aft. (See page 21.)

Fake, A.—One of the rings formed in coiling a rope.

Fall.—The loose end of the rope of a tackle, the hauling part of a tackle; also applied generally to the tackle of the bobstay and the topmast backstays.

Fall Aboard.—One ship sailing or driving into another.

Fall Astern.—The same as drop astern. When two vessels are sailing together, if one fails to keep company with the other by not sailing so fast.

Fall Off.—To drop away from the wind as when a vessel is hove to she is said to fall off when her head falls to leeward, in opposition to coming to; also when a vessel comes up to windward of her course and then falls off to her course or to leeward of it. Not used in the sense of breaking off, which means when the wind comes more ahead and causes an alteration in the direction of a vessel's head to leeward of a course she had previously been sailing.

Fall To.—To join in hauling, to commence work.

Falling Tide—The ebbing tide.

False Keel.—A piece of timber fitted under the main keel to deepen it or protect it when taking the ground.

False Tack.—A trick sometimes practised in yacht racing when two vessels are working close hauled together, and one has been "weather bowing" the other every time they went about. To be rid of this attention the crew of the vessel under the lee quarter of the other makes a sudden move as if about to tack; the helm is put down and the vessel shot up in wind, the other vessel does the same and probably goes on the opposite tack, if she does so the former vessel fills off on her original tack, and the two part company. To shoot up in the wind and fill off on the same tack again.

Fashion Timbers.—The timbers which form the shape of fashion of the stern.

Fast.—Made fast by belaying. (See "Breast Fast," "Bow Fast," "Quarter Fast.")

Fastenings.—The bolts, nails, &c., by which the framing and planking of a vessel are held together.

Fathom.—A sea measure of six feet. To fathom a thing is to arrive at the bottom of it, to understand it.

Fay, To.—To join pieces of timber together very closely. Plank is said to fay the timbers when it fits closely to it.

Feather Edge.—When a plank or timber tapers to a very thin edge, "tapering to nothing."

Feathering.—Turning an oar over on its blade as it comes out of the water.

Feeling her Way.—Proceeding by sounding with the hand lead.

Feel the Helm.—In close hauled sailing when a vessel begins to gripe or carry weather helm. When a vessel begins to gather head way, so that she can be steered, or "feel her helm."

Feint.—To pretend to tack. (See "False Tack.")

Fender.—A sort of buffer made of rope, wood, matting, or other material to hang over the side of a vessel when she is about to come into contact with another vessel or object.

Fend Off.—To ward off the effects of a collision by placing a fender between the vessel and the object which is going to be struck.

Fetch Away.—To slip or move without intention. To fetch sternway or headway is when a vessel begins to move ahead or astern.

Fetch.—In close hauled sailing when a vessel arrives at or to windward of any point or object, as "she will fetch that buoy in two more boards," or "she will fetch the mark this tack," &c.

Fid.—A bar of wood or iron used to keep topmasts and bowsprits in their places. (See pp. 104 and 105.)

A very good plan of fid is used by the south coast fishermen, as shown in the annexed sketch: *a* is the topmast; *y y* the yoke or lower cap; *s* is an iron fid, one end being loaded as shown. The fid is pivoted nearly in the centre, the shorter arm being the lighter. *m* and *n* are slots cut in the topmast. *k* is a small line passing up through a hole in the heel of the topmast, and attached to the fid. To unfid the topmast haul on the heel rope until, by pulling on the line *k* the fid is brought into an oblique position in the slots *m* and *n*; the topmast can then be lowered through the cap. In sending the topmast up the line *k* must of course be kept taut.

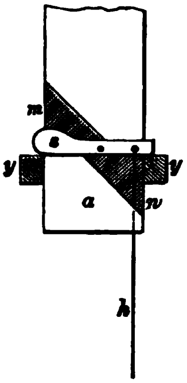


Fig. 108.

Fidded.—When the fid has secured the topmast or bowsprit in its proper place.

Fiddle Block—A long block with one sheave above another.

Fiddle Head.—The curved part of the knee at the upper fore part of the stem in schooners, turned over aft like the curly part of a fiddle head. A scroll head turns over forward.

Fill, To.—When a vessel has been sailed so close to wind that the sails have shaken, and the helm being put up the sails are "filled" with wind. In getting underway after being hove to a vessel is said to fill, or to have been "filled upon."

Fillings or Filling Timbers.—Pieces of wood or timbers used to fill various spaces that may occur in ship building.

Fine.—To sail a vessel "fine" is to keep her so close to the wind that her sails are on the point of shaking; very nice sailing.

Fish, To.—To strengthen or repair a damaged spar by lashing a batten or another spar to it.

Fisherman's Bend.—(See Fig. 78, page 236.)

Fisherman's Walk.—When there is very little deck room, "Three steps and overboard."

Fitting Out.—Getting a ship's rigging, sails, &c. into place after she has been dismantled.

Fitted Out.—When a vessel is "all-a-taunto," which see. A vessel ready to proceed to sea.

Flag Officer.—An Admiral, Vice-Admiral, or Rear-Admiral, also the Commodore, Vice-Commodore, or Rear-Commodore of a club.

Flags.—Pieces of bunting of various forms, colours, and devices, such as ensigns, jacks, burgees, &c.

Flare.—To project outwards, contrary to tumbling home.

Flat Aback.—In square rigged ships when all the yards are trimmed across the ship, with the wind ahead so as to produce sternway.

Flat Aft.—When sheets are trimmed in as close as the vessel will bear for close hauled sailing.

Flat Floored.—When the bottom timbers or floors of a vessel project from the keel in a more or less horizontal direction.

Flatten in Sheets.—To haul in the sheets.

Fleet, To.—To overhaul a tackle or separate the blocks after they have been hauled close together.

Float.—To rest on the surface of the water, contrary to sinking.

Floating Anchor.—Although floating anchors are continually referred to in old writings as a means whereby many ships have been enabled to ride out very heavy gales in comparative ease, we seldom hear of their being used now. No doubt many a ship has been lost through getting broadside on to the sea, whereas they might have kept bowing the sea by such a simple contrivance as a floating anchor. However, masters, it would seem, prefer to heave-to, as they like to keep their vessels under command. In a very heavy sea and gale a floating anchor may be of very great service, and no doubt if a vessel can be kept bow to the sea, she will feel the violence of it in a much less degree than she would if hove-to when she might be continually flying-to against the sea.

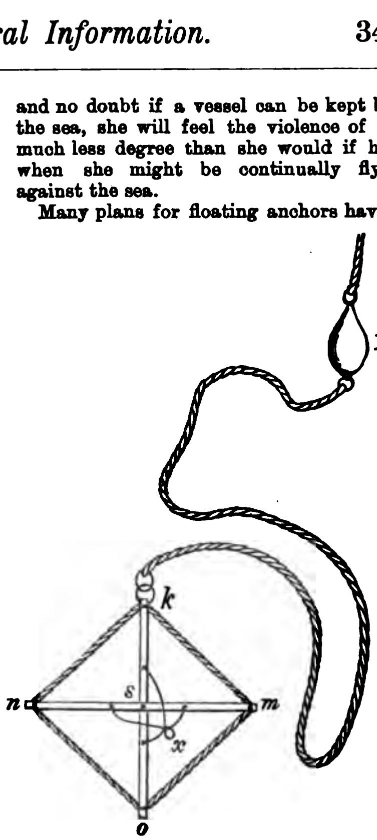


FIG. 109.

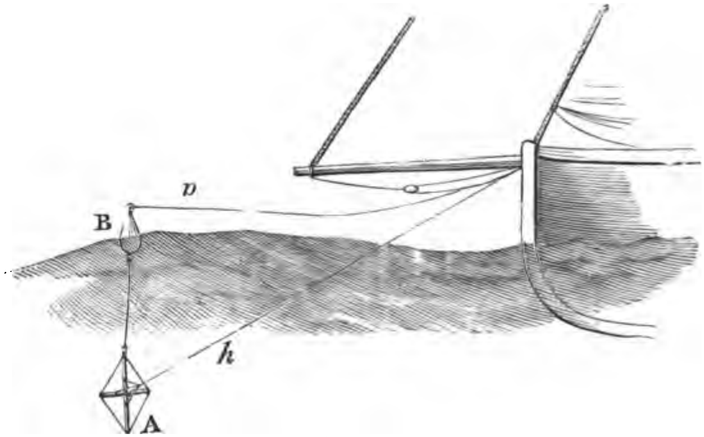


FIG. 110.

Many plans for floating anchors have been used, the simplest being thus made; three spars, in length about two-thirds the beam of the vessel, were lashed together by their ends in the form of a triangle; over this triangle a jib made of stout canvas was lashed. Then to each corner of the triangle a rope was made fast; the ends of these ropes were then bent to a hawser, and thus formed a kind of bridle. A weight was attached to one corner of the triangle to keep it in a perpendicular position; veer out the hawser and ride to 30, 50, or 70 fathoms, according to the sea.

The most approved plan of making a floating anchor is shown by the diagram; *k*, *m*, *n*, *o*, or the ends of two iron bars formed into a cross, and connected by a stout bolt, nut, and pin at their intersections *s*. At each end of the bars is a hole through which a strong rope is rove, hauled taut, and well secured. Thus a square is formed, and over the square a piece of stout canvas is laced to the roping. Four stout ropes are attached to the iron bars, and make a sort of crow foot, the ends being bent and seized to a ring *x*. The hawser is bent to this ring to ride by. To prevent the anchor sinking a buoy, B, is attached to one corner with 6 or 7 fathoms of drift; this buoy will also prevent the anchor "diving" (as it would, like a kite flies into the air) when a strain is brought upon it. A line should be attached to this buoy to lead on board. This line is shown by *p* in the diagram here annexed; *h* is the hawser to which the vessel is riding, A is the anchor, and B the buoy.

To get the anchor on board haul in on the line *p*; this will bring the anchor edgeways, and it can then be readily hauled in.

Floating Dock.—Upon lakes, where there are no tides, and no convenience for hauling a yacht up, a floating dock may be of service to get at the yacht's bottom. The dock would be rectangular in form, of which ⊔ might be a transverse section, and its size would depend upon the weight of the yacht that had to be docked. The weight of the yacht can roughly be arrived at thus: length on load line, multiplied by beam on load line, multiplied by draught of water to rabbet of keel; the product in turn being multiplied by the fraction 0·3. The decimal ·3 is used, as that fairly allows for the quantity cut away from the cube in modelling. Say the yacht is 40ft. long, 8ft. broad, and 6ft. deep to the rabbet in the keel, then 40 × 8 × 6, equal to 1920 cubic feet. 1920 multiplied by 0·3 is equal to 576 cubic feet. There are 35 cubic feet to one ton, and 576 divided by 35 is equal to 16·4 tons. A dock 50ft. long, 16ft. broad, and immersed 2ft., would (omitting of course the reduction by the factor ·3, as the dock would be a cube) be equal to 45 tons; the weight of the dock made of 4-inch deal, would be, if the sides were 10ft. deep, about 20 tons; this would leave a margin of 25 tons for floating at 2ft. draught. A false bottom 2ft. deep would have to be made in the dock; also a door at one end hinged from its lower edge, and rabbeted at the sides. To get the yacht in the dock lower the door and fill the false bottom with water until the dock sank low enough to be hauled under the bottom of the yacht; then close the valve which let the water into the false bottom, shut the door and pump the water out of the false bottom (a hose for the pump should be used in case the dock sank). The yacht should be shored up from the sides of the dock before she took any list. With caution such a contrivance could be used for floating a deep draught yacht over shallows from one lake to another, or through canals; in such cases, if the draught of water for going over the shallows were not limited to 2ft., it would be well to keep the false bottom full or partially full of water.

Flood Tide.—The rising tide, contrary to ebb.

Floors.—The bottom timbers of a vessel.

Flotsam.—The cargo of a wreck that may be floating about or liberated from the wreck.

Flowing sheet.—In sailing free, when the sheets are eased up or slackened off.

Flowing tide.—The rising tide, the flood tide.

Fluid compass.—A compass card in a basin of fluid, usually spirit, used in rough weather because the card should not jump about.

Flukes.—(Pronounced "flues" by seamen). The barbed shaped extremities of the arms of an anchor.

Flush deck.—When the deck has no raised or sunken part.

Fly.—The part of a flag which blows out; the opposite side to the hoist; the halyards are bent to the hoist.

Flying jib.—A jib set in vessels on the flying jib-boom. There is then the jib, the outer jib and flying jib or inner jib, jib and flying jib; probably called flying jib because unlike the others it is not set on a stay.

Flying light.—Said of a vessel when she has been lightened in ballast so as to float with her proper load-line out of water.

Flying start.—In match sailing to start underway. (See page 295.)

Flying to.—When a vessel in sailing free, luffs suddenly, or comes to suddenly; also after tacking, if a vessel's head is kept much off the wind, and the helm be put amidships, the vessel will fly to, *i.e.* fly to the wind quickly.

Fly up in the Wind.—When a vessel is allowed to come head to wind suddenly.

Foot.—The lower edge of a sail.

Fore.—Front; the contrary of aft; the forward part.

Fore-and-aft.—Running from forward aft, in a line with the keel.

Fore-and-aft rig.—Like a cutter or schooner without yards, when all the sails are tacked and sheeted in a line with the keel.

Fore-body.—The fore part of a ship that is forward of the greatest transverse section.

Forecastle.—The space under deck before the mast allotted to the seamen.

Fore Deck.—The deck before the mast.

Fore Foot.—The foremost part of the keel at its intersection with the stem. (See page 90).

Fore Guy.—The stay of a squaresail boom or spinnaker boom which leads forward. (See p. 91.)

Foremast.—The mast which occupies the most forward position in a vessel.

Fore Peak.—The forecastle, a space decked over forward in a small boat to stow gear in.

Fore-rake.—The rake the stem has beyond a perpendicular dropped to the fore end of the keel.

Fore-reach.—When one vessel reaches past or sails past another; generally applied in close-hauled sailing. Thus it is frequently said that one vessel "fore-reaches but does not hold so good a wind as the other;" meaning that she passes through the water faster but does not or cannot keep so close to the wind. (See pp. 22, 295.)

Foresail.—In square rigged ships the large lower-sail set on the foremast; in cutters the triangular sail or jib foresail set on the fore-stay; in fore-and-aft schooners the gaff sail set abaft the foremast.

Fore-staysail.—The jib foresail set on the fore-stay of schooners.

Foresheet.—The sheet of the foresail.

Foresheet horse.—An iron bar for the foresheet to work upon.

Fore topmast.—The topmast over the foremast.

Foreyard.—The yard on the foremast for setting the foresail in squarerigged ships.

Forge ahead.—When a vessel that is hove to gathers way; generally when a vessel moves past another.

Foul.—Entangled, not clear.

Foul Anchor.—When an anchor gets a turn of the cable round its arms or stock, when imbedded among rocks, &c., so that it cannot be readily recovered.

Foul Berth.—When two vessels that are anchored or moored have not room to swing without fouling each other. If a vessel is properly moored and another comes and fouls her berth she is held liable for any damage which may ensue.

Foul bottom.—A rocky bottom, also the bottom of a ship when it is covered with weeds, &c.

Frames.—The timbers or ribs of a vessel.

Frapping.—A rope put round the parts of a tackle to draw them together. Frequently put on the parts of the head sheets of a vessel to draw them in tauter.

Free.—Not close hauled. When a vessel is sailing with a point or two to come and go upon. The wind is said to free a vessel when it enables her to check sheets so as to be no longer close hauled. Also when it enables a vessel that is close hauled to lie nearer her course.

Freeboard.—The side of a vessel which is above water. (See page 91.)

Fresh Breeze.—(See "Wind.")

Freshen.—To alter the strain upon a rope.

Freshen Hawse.—To veer out or heave cable, so that a different part will take the chafe of the hawse pipe.

Freshen the Nip.—To shift a rope, &c., so that its nip, or short turn, or bight, may come in another part.

Full.—When all the sails are filled with the wind and quite steady.

Full Aft.—When a vessel is said not to taper sufficiently aft.

Full and Bye.—Sailing by the wind or close hauled, yet at the same time keeping all the sails full so that they do not shake through being too close to wind. Generally a vessel does better to windward when kept a "good full and bye" than when nipped or starved of wind.

Full and Change.—(See "High Water.")

Full bowed.—The same as bluff bowed.

Furl.—To roll a sail up on a yard, &c.

Futtocks.—The timbers which abut above the floors called first, second, and third futtocks. This should properly be written foothooks.

G.

Gaff.—The yard to which the head of a fore-and-aft sail is bent. (See "Jaws.")

Gaff Topsail.—The topsail set over a gaff sail, such as the topsail set over a cutter's main-sail. Sometimes the sail has a head yard, and sometimes not. (See "Jib-Headed Topsail.")

Galley.—A long narrow rowing boat propelled by six or eight oars. A boat a little longer and heavier than a yacht's gig. Also the caboose, or kitchen of a vessel.

Gammoning.—The lashings which secure the bowsprit to the stem piece, and are passed backward and forwards in the form of an X, over to bowsprit. Now, generally chain is used. In yachts, an iron band or hoop, called the gammoning iron or span-shackle, is fitted to the stem, through which the bowsprit passes.

Gammon Iron.—An iron hoop fitted to the side of the stem, or on top of the stem a span-shackle, to receive and hold the bowsprit.

Gangway.—The opening in the bulwarks, or side, through which persons enter or leave a vessel. Generally a passage, or thoroughfare of any kind. "Don't block the gangway," is a common admonition to thoughtless people who stand about in passages or thoroughfares, to the impediment of passers.

Gangway Ladder.—The steps hung from the gangway outside the vessel. Sometimes there is also a board, or kind of platform, called the "Gangway Board."

Gant-line.—A whip purchase; a single block with a rope rove through it. A Gant-line is used to hoist the rigging to the masthead on beginning to fit out.

Garboard.—The strake of plank next above the keel into which it is rabbeted and bolted. (See *b*, Fig. 19, page 79.)

Garland.—A strop put round spars when they are hoisted on board.

Garnet.—A kind of tackle used for hoisting things out of the hold of vessels; also used for clueing up squaresails.

Gaskets.—Pieces of rope, sometimes plaited, by which sails when furled are kept to the yards. The pieces of rope by which sails are secured when furled, such as the tyers of the mainsail, by which that sail when rolled up on the boom, is secured. (See "Tyers.")

Gather Way.—When a vessel begins to move through the water, under the influence of the wind on her sails. (See "Steerage Way.")

Gawlor.—An open boat which can either be rowed or sailed, common to Portsmouth watermen. They are very skilfully handled by the watermen, and go backwards and forwards to Spithead and elsewhere in all kinds of weather, and seldom meet with mishaps. They are sharp sterned, like the bow, and are rigged with sprit, main, and mizen, and jib foresail. They have no boom to the mainsail.

Get a Pull.—To haul on a sheet or tack or fall of a tackle.

Getting Soundings Aboard.—Running aground.

Gilling.—To gill a vessel along is to sail her very near the wind, so that very little of the weight of the wind is felt by the sails. The sails are kept lifting, and only bare steerage way kept on the vessel.

Gimbals.—The cross axles by which compasses, lamps, &c., are swung on board ship. Generally called "double gimbals."

Girt.—To moor a vessel so that she cannot swing by tide or wind. To draw a sail into puckers; to divide the belly of a sail into bags as by a rope, such as the topping lift of boom.

Girt-line.—(See "Gant-line.")

Give Her.—A general prefix to an order, as "Give her sheet;" "Give her the jib-headed topsail;" "Give her chain," &c.

Give Way.—The order to a boat's crew to commence rowing or to pull with more force or more quickly.

Giving the Keel.—Heeling over suddenly and bringing the keel near the surface; vessels that are not very stiff under canvas are said to "give the keel."

Glass.—The term by which a sailor knows the barometer. Also a telescope, and the sand glass used to denote half-hours on board ship, or the half-minute or quarter-minute glass used when heaving the log.

Glass Calm.—When it is so calm that the sea looks like a sheet of glass.

Go About.—To tack.

Go Ahead!—The order to the engineer of a steam vessel. Also "Go astern;" "Easy ahead;" "Easy astern;" "Stop her!"

Go Down.—To sink. To go down below.

Going Large.—The same as sailing with the wind free. (See "Large.")

Going Through Her Lee.—When one vessel overtakes and passes another vessel to leeward; considered to be a very smart thing for a vessel to do if they are close together and of equal size.

Good Conduct Money.—A douceur of one shilling or more a week given to men at the end of a season for good behaviour, and withheld for the week in which any offence or offences were committed. (See "Conduct Money.")

Good Full.—Same as "Clean Full," or little fuller than "Full and By."

Gooseneck.—An iron jointed bolt used to fix the end of booms to the mast, &c. (See Fig. 79, p. 239.)

Goose Wing.—A schooner "goose wings" when dead before the wind by booming out the gaff foresail on the opposite side to the mainsail. A practice not now in much use in racing, as the introduction of large squaresails and spinnakers have made it unnecessary, but in America, where such sails are not allowed in matches, "goose-winging" is always resorted to. To gybe the gaff foresail of a schooner to the opposite side to the mainsail. (See "Wing and Wing.")

Graduated Sail.—A sail whose cloths taper towards the head from the foot upwards; so that a whole cloth forms the luff as well as the leech. Manufactured by Gordon, of Southampton, and Summers and Hewitt, of Cowes.

Granny Knot.—An insecure knot which a seaman never ties, but which a landsman is sometimes seen to do when trying his hand at reef knots.

Grapnel.—A grapling iron with four claws used to moor small boats by or to reach the bed of the sea.

Gratings.—Open woodwork put in the bottom of boats, in gangways, &c.

Graving.—Cleaning a vessel's bottom.

Graving Dock.—A dock which can be emptied of water by opening the gates as the tide falls, and its return prevented as the tide rises by closing the gates. Used for clearing the bottoms of vessels, repairing the same, &c.

Gravity.—Centre of. (See page 6.)

Great Guns.—A heavy wind is said to "blow great guns."

Green Hand.—A landsman shipped on board a vessel, and who has yet to learn his duties.

Green Sea.—The unbroken mass of water that will sometimes break on board a vessel as distinct from the mere buckets full of water or spray that may fly over her. Such bodies of water always have a green appearance, while smaller quantities look blue, hence we suppose the term.

Gridiron.—A large cross framing over which a vessel is placed at high water in order that her bottom may be examined as the tide falls.

Grin.—A vessel is said to grin when she dives head and shoulders into a sea and comes up streaming with water.

Gripe.—The forepart of the dead wood of a vessel, the fore foot.

Gripe, To.—A vessel is said to gripe when she has a tendency to fly up in the wind, and requires weather helm to check or "pay off" the tendency. (See "Weather helm.")

Grommet.—A ring formed of a single strand of rope laid over three times. Used for strops, &c.

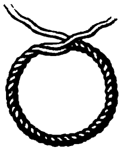


FIG. 111.

Grounding.—The act of getting aground or taking the ground as the tide falls.

Ground Sea, Ground Swell.—The swell that may be seen along shore sometimes, whilst in the offing the sea is calm.

Ground Tackle.—The moorings, anchors, chains, &c., used in securing a vessel.

Ground Ways.—The blocks next to ground on which a vessel is supported whilst she is being built.

Gudgeons.—Metal eye bolts fitted to the stern posts to receive the pintles of the rudder. (See "Braces.")

Gunwale.—The top strake of small boats which fits over the timber heads. (See "Inwale.")

Gunwale Under.—Heeling until the lee gunwale is in the water.

Guy.—A rope used to steady a spar or keep it in its position.

Gybing (also spelt jibing and jib-bing).—To keep a vessel so much off the wind that at last it blows on the opposite side and causes the sails to shift over. The opposite of tacking, which is to come to the wind until it blows on the opposite side of the vessel to the one on which it has been blowing.

H.

Hail.—To speak to a ship at sea by signals or otherwise. To attract the attention of a ship by singing out "Ship ahoy!" or "Neptune ahoy." To "hail from" a locality is to belong to a particular place by birthright.

Half-breadth Plan. — A drawing showing the horizontal sections or water-lines of a vessel by halves.

Half-breadths.—The width of horizontal sections at particular points.

Halyards or Halliards, or Haulyards.—Ropes or tackles for hauling up sails, yards, &c., by.

Hammock.—A canvas bed swung underneath the deck beams.

Hand.—To hand a sail is to stow, furl, or take in; hence a sail is said to be "handed" when either of these operations has been performed upon it.

Hand.—A man. A member of a ship's crew. To hand a sail is to take it in or furl it, as hand a jib; hand a squaresail.

Hand Lead.—(See "Lead.")

Handle Her.—An admonition to the crew to be smart in working the sheets in tacking or gybing. Also a steamboat master is said to "handle" his vessel in bringing her alongside a wharf, pier, &c.

Hand over Hand.—Hauling on a rope by one hand at a time and passing one hand rapidly over the other to haul. A very rapid way of hauling, hence anything done rapidly is said to be done "hand over hand."

Hand over Fist.—(See "Hand over Hand.")

Handsomely.—Steadily; with care. Not too fast nor yet too slow, but with great care; cleverly. As "Lower away handsomely." In easing up a sheet, if the man is likely to let it fly, the master or mate will sing out, "Handsomely there!" meaning that the man is to ease up the sheet carefully, not letting too much run out nor yet letting it come up with a jerk nor yet allowing it to run away with him.

Handspike.—A bar of wood, usually of ash, used as a lever.

Hand Taut.—As tight or taut as a rope can be got by the hand without swigging upon it.

Handy.—A vessel is said to be handy when she answers her helm quickly, and will turn in a small circle, or go from one tack to the other quickly.

Handy Billy.—A watch tackle kept on deck for general use to get a pull on whatever is required, such as sheets, tacks, or halyards.

Hang.—To lean towards. To hang to windward is to make but little leeway. "Hang on here!" an order for men to assist in hauling on a rope.

Hanging Compass.—A compass suspended under the beams so that it hangs with the face of the card downwards; termed also a "Tell-tale Compass."

Hanging Knee.—Knees that help keep the beams and frame together; one arm is bolted to the under side of a beam, the other to the frame.

Hank for Hank.—Slang for "tack for tack."

Hanks.—Rings or hooks made of rope, wood, or iron for fastening the luff of sails to stays. Iron rings are usually used for the stay foresail; iron hooks for the balloon foresail and jib topsail.

Harbour Master.—An officer whose duty it is to see that vessels are properly berthed and moored in harbours. His authority cannot be disputed with impunity, as, in nine cases out of ten, if a dispute with a harbour master gets into court the decision will be for the harbour master.

Harbour Watch.—The watch kept on board a vessel at night when she is riding to an anchor in harbour; the same as anchor watch.

Hard.—A landing place usually made of gravel, piles, &c., across mud, as the "Common Hard," Portsea, where the small boats land and take in passengers.

Hard Down.—The order to put the helm hard-a-lee. Hard-a-port; hard-a-starboard; hard-a-weather; hard up.

Hard in.—Sheets are said to be hard in when a vessel is close-hauled.

Harpings.—Pieces of timber or battens that are fitted around the frames of a vessel to keep the frames in their places before the plank is put on.

Hatches.—The coverings for hatchways or openings in the deck.

Hatchway Coamings.—The raised frame above the deck upon which the hatches rest.

Haul.—To pull on a rope.

Haul Aboard.—To get the main boom hauled in on the quarter for close-hauled sailing.

Haul Aft the Sheets.—The order to haul in the sheets for close-hauled sailing.

Haul Her Wind.—To become close-hauled after sailing free. Generally to sail closer to the wind when sailing free. Haul to the wind. Haul on the wind.

Haul Round a Mark, Point, &c.—When a vessel in sailing free has to come closer to the wind as her course alters. By hauling in the sheets the vessel will sometimes luff sufficiently without any help from the helm.

Haul Up.—To hoist a sail. A vessel is said to "haul up" when she comes or is brought nearer the wind or nearer her course if she has been sailing to leeward of it.

Hawse Pipe.—The pipes in the hawseholes in the bow of a vessel through which the cables pass.

Hawser.—A large rope laid up with the sun or right-handed.

Hawse Timbers.—The large timbers in the bow of ships in which the hawseholes are cut.

Head.—The fore part of a vessel. The upper part of a sail. "By the head" means pressed or trimmed down by the head, in contradistinction of "by the stern." To head is to pass ahead of another vessel.

Head Earings.—The earings of the upper part of a squaresail, &c.

Heading.—The direction of a vessel's head when sailing. Generally used when sailing close hauled, as "she headed S.E. on port tack, and N.E. on starboard tack." In such cases it is never said she "steered S.E.," &c., as practically the vessel is not steered, but her course alters with the wind. A vessel "steers" such and such a course when she is sailing large.

Headland.—A high cliff or point.

Headmost.—The first in order.

Head Reach.—In sailing by the wind when a vessel passes another either to windward or to leeward. (See "Fore-reach.")

Head Rope.—The rope to which the head of a sail is sewn.

Head Sails.—A general name for all sails set forward of the foremost mast.

Head Sea.—The sea met when sailing close-hauled. In the case of a steamship she may meet the sea stem on.

Head Sheets.—The sheets of the head sails.

Head to Wind.—When a vessel is so situated that the wind blows no more on one bow than the other; when her head is directly pointed to the wind.

Head Way.—When a vessel moves ahead through the water.

Head Wind.—A wind that blows directly down the course a vessel is desired to sail. A foul wind. To be headed by the wind is when the wind shifts so that a vessel cannot lie her course, or puts her head off to leeward of the course she has been heading.

Heave.—To bring a strain or drag upon a capstan bar, purchase, &c. To throw as "heave overboard."

Heave About.—To go into stays to tack.

Heave Ahead.—To draw a vessel ahead by heaving on her cable, warp, &c.

Heave-and-Away.—The last heave of the capstan that breaks the anchor out.

Heave in Stays.—The same as heave about.

Heave Short.—To heave on the cable until the vessel is over the anchor, or the cable taut in a line with the forestay, so that with another heave, or by the action of the sails, the anchor will be broken out of the ground.

Heave To.—To so trim a vessel's sails that she does not move ahead. The same as "lie to" or "lay to" as sailors call it.

Heave the Lead.—The order to cast the lead for sounding.

Heave the Log.—The order to throw the log ship overboard to test the rate of sailing.

Heel.—The lower after end of anything, as heel of the keel, heel of the mast (the fore part of the lower end of a mast is called the toe), heel of a yard, heel of the bowsprit.

Heeler.—A heavy puff that makes a boat heel over.

Heel Rope.—The rope by which a running bowsprit is launched out.

Heel To.—To incline, to careen, to list over, to depart from the upright.

Height.—A distance measured in a vertical direction, as height of freeboard, &c.

Helm.—The apparatus for steering a vessel, but usually applied only to the tiller. The word is derived from *helma* or *healma*, a rudder; German *helm*, a handle and a rudder.

Helm's A-lee.—The usual call made in tacking or going about in, as a signal for the crew to work the sheets, &c. The helm is a-lee when the tiller is "put down" or to leeward. (See "Lee Helm" and "Weather Helm.")

Helm Port.—The rudder trunk in the counter of a vessel.

Helm, to Port the.—To put the helm or tiller to the port side, and thereby bring the vessel's head round to starboard. If a wheel is used besides a tiller the action of turning the wheel to port brings the vessel's head round to port, as the tiller is moved by the chains to starboard. Thus with a wheel, when the order is given to port the wheel is turned to starboard.

Helm, to Put Down the.—To put the tiller to leeward, and thereby bring the vessel to the wind, or luff; the contrary action to putting up the helm.

Helm, to Put Up the.—To bring the tiller to windward, so that the rudder is turned to leeward, and consequently the head of the vessel goes off to leeward or "off the wind."

Helm, to Starboard the.—To put the tiller the way opposite to port.

Helm, to Steady the.—To bring the helm or tiller amidships after it has been moved to port or starboard, as the case may be.

Helmsman.—The man who steers a vessel. If a man can sail a vessel well on a wind he is generally termed a good "helmsman," and not steersman.

Hermaphrodite Brig. — A two-masted vessel, square-rigged forward, and fore-and-aft canvas only on mainmast.

High and Dry.—The situation of a vessel that is ashore when the ebb tide leaves her dry.

High Water: Full and Change.—On all coast charts the time of high water at the full moon and new moon is set down, the time of high water at the full moon and new moon, always occurring at the same hour throughout the year; therefore, if the time of high water at full and change is known, and the age of the moon, the time of high water for any particular day can be roughly calculated, about twenty-five minutes being allowed for each tide.

Hipping.—To make a vessel broader on the beam about the water-line. It is an American term, and became generally known in England in connection with the celebrated American yacht Sappho. After her defeat by the English yacht Cambria, in the match round the Isle of Wight in 1868, she was taken to New York and hipped; that is, her planking was stripped off amidships, and each frame backed with timber, so that the vessel might be made to have more beam about the water-line. The backing is "faired" to the frames and then planked over. Sometimes, if it is not sought to give the vessel more than five or six inches more beam, the hipping is accomplished by a doubling of plank; in such cases a rabbet is cut for the edges of the new plank in the old plank; the seam is then caulked and payed. If the new planks were worked to a feather edge water would get underneath, and it might soon bring about decay.

Hire of a Yacht.—The hire of yachts varies from 30*s.* per ton per month to 40*s.* per ton. Usually the owner pays all wages, excepting those of the steward and cook; also often provides for the mess of the master and mate. The crew always provision themselves; the owner clothes the crew. The hirer pays insurance, and contributes to laying-up expenses. The exact details of hiring are usually a matter of special arrangement. Sometimes at the end of a season, if a yacht is already fitted out, she may be hired for a less price per month. In all cases when a yacht is wanted on hire, the best plan is to advertise.

Hitch.—A mode of fastening a rope. There are many kind of "hitches," such as Blackwall hitch, timber hitch, clove hitch, rolling hitch, &c. A hitch is also a short tack or board made in close-hauled sailing.

Hogged.—The situation of a vessel when she rises higher in the middle part than at the ends; the opposite of sagged.

Hogging Piece.—A piece of timber worked upon top of the keel to prevent its hogging or rising in the middle. (Fig. 19, page 79.)

Hoist.—The length of the luff of a fore-and-aft sail, or the space it requires for hoisting. The hoist of a flag is the edge to which the roping is stitched.

Hoist, To.—To raise anything by halyards or tackles, &c.

Hoisting the Pennant.—A commodore is said to hoist his pennant when he goes on board the first time: his pennant being then hoisted.

Hold.—The interior of a ship; generally understood to mean the space in which cargo, &c., is stowed away.

Hold-a-wind.—To sail close to the wind.

Hold her Head Up.—A vessel is said to "hold her head up" well that does not show a tendency to fall off.

Holding On.—To continue sailing without altering a course or shifting sail.

Holding On to the Land.—To keep the land aboard in sailing; not departing from the land.

Holding Water.—Resting with the blades of the oars in water to check a boat's way or stop her.

Hold On.—The order given after hauling on a rope not to slack any up, as "Hold on all that."

Hold On the Fore Side.—If, when hauling on the fall of a tackle, some of the hands have hold of it on the tackle side of the belaying pin, the hand that has to belay sings out, "Hold on the fore side," and "Come up behind." The hands on the fore side thus hold the fall and keep it from running through the blocks whilst it is being belayed. (See "Come Up.")

Hollow Lines.—The horizontal lines of a vessel that have inflections.

Hollow Sea.—When the waves have a short, steep, and deep trough.

Home.—Any operation that is completely performed, as "sheeted home" when the clew of a sail is hauled out to the last inch, &c. An anchor is said to come home when it breaks out of the ground.

Hood.—A covering for skylights, sails, &c.

Hood Ends.—The ends of the plank which are fitted into the rabbet of the stem or stern post; termed also the hooded ends, meaning probably that they are "housed" or covered in by the rabbet.

Hooker.—A small coasting craft.

Hoop.—(See "Mast Hoop" and "Spider Hoop.")

Horizontal Lines.—The curved lines on the Half-breadth Plan which show the water sections, the plane of each section being parallel to the horizon.

Horizontal Keel.—A plate of iron fitted to the underside of a boat's keel, a fore-and-aft view showing thus ⊥. The plate should be made of iron plate of from ⅛in. to ⅜in. in thickness. For a boat 12ft. long the plate should be 8in. wide at the middle (so as to project about 3in. on either side of the keel), and 8ft. long, tapering each end to the width of the wood keel, to the underside of which it is screwed.

The wood keel should extend at least 3in. below the garboards to render the plate effective. It is necessary that the plate should be kept horizontal, or in other words, in the same plane as the horizon; inasmuch as if the keel dips forward or aft the tendency of the plate will be to draw the boat either by the head or stern. A horizontal keel will increase a boat's weatherliness, but not to the extent of a centre board. The deeper the wood keel of the boat is the more effective the horizontal plate will be, as it will clear the eddy water along the garboards, and prevent the possibility of the bilge of the boat as she heels over being lower than the keel. However, if a very deep keel is necessary to make the horizontal plate effective, it may be as well to have another inch or so, and dispense with the plate altogether. The plan does not appear to have met with much favour.

Horns.—The projections which form the jaws of gaffs or booms. The outer ends of the crosstrees are sometimes termed horns.

Horse.—A bar of iron or wood, or a rope for some part of a vessel's rigging to travel upon.

Hounds.—The projections on a mast which support the lower cap and rigging. (See pages 90 and 94.)

House.—To lower a topmast down within the cap. A snug house is when very little of the topmast shows above the upper cap.

Housing of a Mast.—The part under the deck.

Hove Down.—Said of a vessel that is very much careened or heeled by the wind or other cause.

Hove her Keel Out.—Said of a vessel that heels over, so as to show her keel. (Generally used only as a figure of speech)

Hove in Sight.—To come into view; said of a sail that appears above the horizon or round a headland; also of the anchor when it comes above water.

Hove in Stays.—Said of a vessel when she tacks, often meaning that a vessel tacks suddenly.

Hove Short.—When the cable is hove in so that there is but little more length out than the depth of water.

Hove-to.—Vessels hove-to on port tack should fill or get way on, if approached by a vessel on the starboard tack; but if the vessel on port tack can, by hailing or otherwise, make the other vessel understand the situation, the latter should give way; this is the custom of the sea, but there is no statutory regulations concerning the point.

Hove To.—The situation of a vessel with her head sails aback, so that she has no way on.

Hoy. — A small vessel. An abbreviation of "Ahoy."

Hug the Land.—To sail along as close to a weather shore as possible.

Hug the Wind.—To keep very close, or too close to the wind.

Hulk.—A vessel whose seagoing days are over, but is still useful as a store ship, &c.

Hull.—The ship, as distinct from her masts and rigging. To hull, to strike the hull with shot, &c.

Hull Down.—On the sea when only a vessel's spars appear above the horizon.

Hull-to, or A-hull.—With all sails furled and the helm lashed to leeward, leaving the waves to do their worst.

I.

Immersed. —Under water. The opposite of emersed, which means taken out of water. The "wedge of immersion" is the part of a vessel put into the water when she heels over. The wedge of emersion is the part taken out of the water. Sometimes termed the "in" and "out" wedges.

In.—The prefix to a curt order to take in a sail, as "In spinnaker," "In squaresail," or "In boats," &c.

In and Out Bolts.—Bolts that pass through the skin and frame of a vessel.

In Board.—Inside a vessel's bulwarks, being the opposite to outboard.

In Bow.—In rowing, the order to the bow man to throw up his oar and be ready with the boat hook, to help bring the boat alongside.

Inclination.—Heeling from an upright position. Synonymous with careening and listing.

Inner Jib.—The jib next the forestay sail in schooners where two jibs are carried.

Inner Post.—A piece of timber sometimes worked inside the sternpost.

In Haul.—A rope used to haul sails on board, as the inhaul of a jib or spinnaker.

In Irons.—A vessel is said to be in irons when she is brought head to wind, and, having lost her way, will not fall off on one tack or the other.

Initial Stability.—The resistance a vessel at the first moment offers to being heeled from the upright position, as distinct from the resistance she may offer to being further heeled when inclined to considerable angles. Thus beamy boats are said to have great initial stability, because they resist powerfully, being heeled to small angles; narrow vessels, on the other hand, are readily heeled at first, but may offer greater resistance, as they are farther heeled, whereas a beamy boat's resistance may rapidly decrease as she gets over to large angles of say 30°.

Inlet.—A creek. A pipe to admit water to the hold.

Inshore.—Close to the shore.

In the Wind.—When sailing close hauled, if a vessel comes to nearly head to wind she is said to be "all in the wind."

In wale.—The clamp or strake of timber inside the gunwale of a small boat. (See "Gunwale.")

Irish Pennants.—Loose ends of ropes, &c., hanging about a vessel's rigging or sails.

Iron Moulds.—Diluted oxalic acid will remove iron moulds from sails; but the instant the iron mould is removed the part should be well rinsed or soaked in fresh water, or it will be rendered rotten.

J.

Jack.—The typical British flag that has "braved a thousand years, the battle and the breeze." It originally only had the red St. George's cross on a white field. Upon the accession of the Scotch King James to the English throne, St. Andrew's cross on a blue ground was added, and the flag was thereupon termed the "Union Jack" and National Flag, "For the Protestant religion and liberty." The red cross of St. Patrick was added (over the white St. Andrew's cross) upon the union with Ireland 1801. (See St. George's Jack.)

Jack in the Basket.—A boom or pole with a cage on the top used to mark a shoal or bank.

Jack Screw.—A powerful screw used for moving heavy weights.

Jack Stay.—A rod of iron, or rope, usually of wire, for sails or yards to travel on. Also the wire stay on the boom of laced sails, round which the lacing is passed.

Jack Yard. — The small yard on the foot of balloon topsails to extend them beyond the gaff. Termed also jenny yards and foot yards.

Jam.—In belaying or making fast a rope to close up or jam the turns together. To clinch the hitch of a rope.

Jaws of a Gaff.—The horns at the end of the gaff which half encircle the mast. A rope called a "jaw rope," or jaw parrel, is fitted to the ends of the horns, and, passing round the mast, keeps the gaff in its place. Wood beads are rove on to the rope to make it slide easily on the mast.

Jenny Yard.—(See "Jack Yard.")

Jesty's Composition.—This is a composition in great request for coating the bottoms of iron and wooden ships. Before applying it give the vessels one or two coats of coal tar thinned with turpentine; when this has dried on apply a couple of coats of the composition; a priming of red lead is sometimes used instead of coal tar. The composition should be kept well stirred in the pot whilst it is being applied, as some of its ingredients are very heavy. (See "Composition.")

Jetson. — Goods thrown overboard in heavy weather to lighten the ship. (See "Flotsam.")

Jib.—The outer triangular sail set on the bowsprit. A cutter usually carries six jibs—balloon jib, No. 1, 2, 3, 4, and 5 jib, the latter being the storm jib.

Jibb or *Jibe.*—(See "Gybe.")

Jib-boom. — The spar beyond the bowsprit in schooners upon which the outer jib is set.

Jib Foresail. — In schooners the fore-staysail. (See "Fore-staysail.")

Jib Stay.—In schooners the stay to which jibs are hanked.

Jib Topsail.—A triangular sail made of duck set upon the topmast stay.

Jib Traveller.—The iron hoop on the bowsprit to which the jib tack cringle is hooked.

Jigger Mast.—The mizen mast of yawl or dandies.

Joggles.—Notches cut in timber.

Join Ship.—To come on board a vessel, or to enter as a seaman on board.

Jolly Boat.—A boat larger than a dinghy, and not so large as a cutter.

Jumpers.—A short frock made of duck worn by sailors. The triatic stays of schooners when they are double. (See page 106.)

Junk.—Old rope. Also old salt beef as tough and hard as old rope. Also a Chinese ship.

Jury.—A makeshift or temporary contrivance, as jurymast, jury rudder, jury bowsprit, &c., which may be fitted when either has been lost or carried away.

K.

Kamsin.—A south-westerly wind which is said to blow on the Nile for fifty days during March and April. The simoom.

Kedge. — The smallest anchor. a yacht carries, used for anchoring temporarily by a hawser or warp. To kedge is to anchor by the kedge, or to carry the kedge anchor out in a boat and warp ahead by it.

Keg.—A small cask, or breaker.

Keel.—The fore-and-aft timbers in a vessel to which the frames and garboard strake are fastened.

Keel.—An awkward-looking north-country boat with one lugsail forward.

Keel Haul.—A mode of punishment formerly in use in the Royal Navy. A rope, passed underneath the bottom of the ship, was made fast to each yard-arm. A man with a weight fast to his feet was made fast to one part of the rope and hauled from one yard-arm to the other, passing underneath the bottom of ship. Keel hauling now facetiously means "undergoing a great hardship" of some kind.

Keelson or *Kelson.*—An inside keel fitted over the throats of the floors. (See Fig. 20, page 81.)

Keep her Full.—When close hauled, an admonition not to keep too close to the wind.

Keep Off.—An order to sail more off the wind; to put the helm up.

Keep your Luff.—An admonition to keep close to the wind. In match sailing, an order given when a vessel is being overtaken by one coming up from astern not to give way and allow the vessel to pass to windward. It is an old maxim in close-hauled sailing, "keep your luff and never look astern," meaning that if you sail as close to the wind as possible the overtaking vessel must take her passage to leeward or risk a collision by trying to force a passage to windward.

Kentledge.—Pig iron used as ballast.

Ketch.—A two-masted vessel, something like a yawl, but with the mizen stepped ahead of the stern post, and not abaft it as a yawl has it. Ketches were formerly common in the Royal Navy for yachts and bomb boats. A rig now seldom used except by coasters; it has all the disadvantages of the schooner or yawl rig, and none of the advantages.

Kevel or *Cavel.*—Large pieces of timber used for belaying ropes to such as the horizontal piece which is bolted to the stanchions aft to belay the main sheet to.

Key Model.—A model made by horizontal layers or vertical blocks, showing either the water lines or vertical sections of a vessel.

Kit.—A sailor's belongings in the way of clothes, &c., which he carries in his bag or keeps in his locker.

Kittiwake.—A kind of seagull.

Knees.—Pieces of timber or iron shaped thus L, used to strengthen particular parts of a ship. A hanging knee is the one fitted under the beams (see in Fig. 21, page 81); a lodging knee is a knee fitted horizontally to the beams and shelf, or to the mast partners or deck beams. Floor knees are V-shaped, like breasthooks. (See *n*, Fig. 19, page 79.)

Knight Heads.—Strong pieces of timber fitted inside the stem to bear the strain of the bowsprit. Called also "bollard timbers." The name is said to be derived from the windlass bitts, the heads of which formerly were carved to represent the heads of knights.

Knot.—A geographical mile, or sixtieth part of a degree, termed also a sea mile or nautical mile. The Admiralty knot or mile is 6080ft., a statute mile 5280ft.; a sea mile = 1·1515 statute mile; a statute mile = ·86842 sea mile.

L.

Labour.—A ship is said to labour when she pitches and rolls heavily, causing her frame to work.

Lace.—To pass a rope in and out.

Laid.—The make of a rope, as cable laid, hawser laid, single laid, laid with the sun, &c.

Land.—To go from a vessel to the shore; also to place anything. The outer edge of the plank of a clincher-built boat.

Land Fall.—The point or part of a coast a vessel first sights after being at sea. To make a good land-fall is to sight the land at the point calculated.

Land Lubber.—A person unacquainted with the duties of a seaman, and one never likely to learn them.

Landsman.—Men who have just joined a ship to train as seamen.

Lane.—A lane of wind is a current of air that travels in a narrow space and does not spread. On board ship the order to "Make a lane there," when a lot of men are standing together, is for them to stand on one side so that others can pass.

Lanyards or *Laniards.*—Ropes rove through dead eyes, &c., by which shrouds and stays are set up. (See page 98.)

Larboard.—Now obsolete, meaning the left side. In consequence of frequent blunders occurring through "larboard" being misunderstood for "starboard" or *vice versâ*, "port," as a distinctive sound, was introduced instead of larboard.

Larbolins.—The men composing the port watch. (See "Starbolins.")

Large.—With the wind abeam or abaft the beam. "She is sailing along large" means that the ship has the wind abeam or between the beam and the quarter.

Lash.—To lace, to bind together with a rope.

Lashing.—A lacing or rope to bind two spars together, &c.

Lateen Sail.—A large triangular sail, with the luff bent to a yard. It really has no head. (See page 161.)

Launch.—The largest boat carried by a ship. To launch is to move an object, as "launch a spar forward," to launch a ship.

Launching a Boat Across a Flat Shore.—In making a truck to launch or beach a boat on a sandy or loose gravelly shore, the truck should run on rollers in preference to wheels, as the latter will sink into the sand or gravel, and render the transit very laboursome.

Lay.—Used by sailors instead of the neuter verb "to lie:" as "lay to" for lie to, "lay her course" for lie her course, "lay up" for lie up, &c., or "she lays S.W." for lies S.W. This use of the active verb is sometimes justified by an appeal to the well-known naval song—

'Twas in Trafalgar's Bay
We saw the Frenchmen lay.

But, whether right or wrong, a sailor will never be brought to say, "there she lies" for "there she lays, or "she's going to lie up" for "she's going to lay up."

Lay along the Land.—When a vessel can just keep along a weather shore close-hauled.

Lay her Course.—A vessel is said to lay her course when sailing close-hauled, if her head points nothing to leeward of it.

Lay in Oars.—An order given to a boat's crew to toss their oars aboard; generally curtly spoken "Oars." To "lie on your oars" is an order for the men to cease rowing, but not to toss their oars up; to rest on their oars.

Lay of a Rope.—The way the strands of a rope are laid up.

Lay Off.—To transfer the design of a vessel to the mould loft full size. This is never written or spoken "lie off." (See page 127.)

Lay Out.—To move, as to lay out on a yard-arm.

Laying Up.—Dismantling a yacht after a cruise has been brought to a termination. It is always much the best plan to have a mud dock dug for the yacht to lie in, as then the bottom will not foul, and if the vessel be coppered, she will haul out quite clean; on the other hand, if she lies afloat, weeds and barnacles will accumulate on the bottom. It is much the practice now to haul vessels up high and dry during the winter months; this is an excellent plan, and greatly assists in preserving the hull. The ballast is removed, and the inside of the hull below the platform coated with red lead, black varnish, or a mixture of two-thirds Stockholm tar to one-third of coal tar; black varnish or red lead is, however, to be preferred. The mast should be taken out before the vessel is hauled up, and with the other spars housed. In case the mast be not removed, all the rigging should be lifted over the mast, and the yoke taken off as well, so that no accumulation of damp may rot the masthead. (See "Limber Boards.")

Lazy Guy.—The guy used to prevent the main boom falling aboard when a vessel is rolling.

Lazy Tack.—A running bight put on the tack cringle of a sail, and round a stay to keep the sail from blowing away whilst it is hoisted.

Lead.—A long weight or "sinker," of 7lb., 14lb., or 28lb. The line is "marked" thus:

Fathoms.	
2	a piece of leather in two strips.
3	„ leather three strips.
5	„ white calico.
7	„ red bunting.
10	„ leather with a hole in it.
13	„ blue serge.
15	„ white calico.
17	„ red bunting.
20	„ two knots.

There are usually 5 fathoms beyond this unmarked. In heaving the lead, if the vessel has headway, the lead must be cast ahead, so that when it touches the bottom the vessel is directly over it. If the first white mark is just awash when the lead is on the bottom, the leadsman sings out, "By the mark five." If it is less than five, say 4¾, he sings out "Quarter less five," And not 4¾. If ¼ or ½ more than five, he sings out "and a quarter five," &c. There are no marks for 1, 4, 6, 8, 9, 11, 12, 14, 16, 18, and 19 fathoms, and these numbers are called "deeps;" in sounding, the leadsman has to estimate the depth, as, for instance, between 5 and 7 marks, and will sing out, "By the deep 6." The deep-sea lead, pronounced "dipsey lead," weighs from 28lb. to 35lb., and has a much longer line. Up to 20 fathoms it is marked the same as the hand lead—at 30 fathoms 3 knots, at 40 fathoms 4 knots, and so on; the intermediate "fives" being marked by a piece of leather or a small strand with a knot in it; 100 fathoms is marked by a piece of bunting, and then commence the knots again—1 knot 10 fathoms, and so on. In sounding with the deep-sea lead the vessel is usually hove to.

Lee.—The opposite side to that from which the wind blows.

Lee Board.—A very old-fashioned contrivance to check leeway. The board is usually trapeziform, and hung from the gunwale on either side. The board in length should be about one-fifth the length of the boat, and at its broadest part two-thirds its own length in breadth, and its narrowest one-third its own length. If the board is fixed to an open boat, the gunwale should be strengthened at the point of attachment by a piece of timber worked inside at the back of the boat's timbers. For a boat 17ft. long this strengthening piece should be at least 5ft. in length by 6in. in depth, and be of 1¼in. thickness. The board will be pivoted at its narrow end by an inch bolt; the neck of the bolt which passes through the board should be square, and a square iron plate should be fitted each side of the board, through which plates the bolt will pass. The round part of the bolt will pass through the gunwale and strengthening piece; the bolt will be tightened up by a thumb nut, and, to prevent the latter working into the strengthening piece, it will be best to have an iron plate inside over the hole in the gunwale. The board should be made of inch stuff, with two through bolts of ⅜in. galvanised iron rod.

A very good plan for a lee board was recommended in the *Field* a short time ago. It consists of a board about 16in. by 2ft., suspended over the side of the boat (the top of the board being level with the keel) by two irons, which reach up the side over the gunwale, and are turned up along the midship thwart, to which they are fastened by means of two thumb screws; at the lower end two screw bolts connect the irons with the board; if necessary, one might be fitted on each side of the boat.

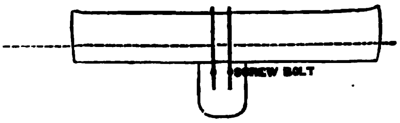


FIG. 112.

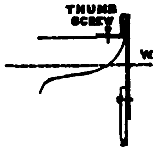


FIG. 113.

The advantages over the ordinary lee-board are that it is not unsightly, is always held parallel to the keel without straining the side, and two turns of the thumb screws will disconnect it in a moment from the boat. By unscrewing the irons, they, with the board, take up no room in the bottom of the boat.

If these irons be fixed to different thwarts, a long board might be fitted in the same way; but most men would prefer a deep to a long one for going to windward.

Lee, By the.—In running nearly before the wind, when a vessel runs off her helm so much as to bring the wind on the quarter over which the boom is; a very dangerous proceeding, as if there be no boom guy a sudden gybe, or a gybe "all standing," may be the result. For safety, the helm should be put down the instant a vessel begins to run off. In match sailing, in running for a mark, yachts are often brought by the lee through a shift of wind, and frequently they are kept so, if a spinnaker or squaresail be set, and if near the mark, to save a gybe, every precaution being of course taken to prevent the main boom coming over by hauling on the guy or pressing against the boom; this risk, however, should only be run in very light winds.

Lee-going Tide.—The tide that is running to leeward in the direction of the wind. The opposite to weather-going tide, which see.

Lee Helm.—The helm put to leeward to keep a vessel to or by the wind. Synonymous with slack helm. If the centre of effort of the sails is much forward of the centre of lateral resistance, the vessel will have a tendency to fall off, and will require the helm to be put to leeward to keep her close to wind. The tendency can be checked by reducing the head sail, or by hardening in the sheets of the after sail and easing the sheets of the head sail. A vessel that requires lee helm will be an awkward one, and in a heavy sea a dangerous one to work to windward. The contrary to "weather helm," which see.

Lee Scuppers.—Inside the lee bulwarks by the scupper holes. To be always in the lee scuppers is to be always in disgrace.

Lend a Hand Here.—An order to a person to assist.

Let go and Haul.—In tacking a square rigged vessel the order given to let go the lee braces and haul in on the others.

Let Her Feel the Weight of It.—An order to keep a vessel more off the wind, and not allow her sails to shake.

Life Belts.—Appliances for support in the water. The cork life belts of the National Lifeboat Institution (6*s.* each), John-street, Adelphi, are the most highly recommended.

Lights.—The lights which all vessels must exhibit between sundown and sunrise. (See "Side Light.")

Limber Boards.—Plank covering the floors of a vessel near the keelson. These should be removed when a yacht is laid up, so that the hold may be thoroughly cleansed of all bilge water accumulations. In yachts built with iron knee floors as shown on page 78 and 79, it is a common practice to fill up all cavities along the keel or hogging piece, fore dead-wood and apron, and dead-wood aft, with cement, first carefully coating the wood with Stockholm tar.

Limber Clearer.—A small chain which is kept rove through the limber holes in the floors at the side of the keelson, to allow the bilge water to flow freely to the pumps; occasionally the chain is worked backwards and forwards to clear the holes. This contrivance is seldom met with in yachts.

Line.—A general name for a rope, or cordage.

Liner.—A line-of-battle ship. An old name for ships of the first and second rate, as three deckers and two deckers. We believe the term is not applied to fighting ships of the present day.

Lines.—A general term applied to the drawing or design of a vessel as depicted by fore-and-aft lines. A vessel is said to have "fine lines" when she is very sharp fore-and-aft.

List.—A vessel is said to list when from some cause—shifting of ballast or cargo or weights—she heels over.

Listing.—A narrow strip of plank, usually 4in. in width, cut out of the plank in ship throughout her whole length, in order that the condition of her frames or timbers may be examined.

Lizard.—A piece of rope with a thimble eye spliced in one end, used in setting squaresails; sometimes the lizard is of two or more parts with a thimble in each, the whole being spliced into one tail. (See page 239.)

Lloyd's Register.—The committee appointed in 1824 by "Lloyd's Society of Underwriters for the insurance of ships," to classify and regulate the building of, and keep a registry of all ships.

Lloyd's Yacht Register.—A register of yachts founded by Lloyd's, 1878, in which the build, age, condition, &c., of each yacht is set forth. The published register also contains rules and tables of scantling for the building of yachts. The offices are White Lion Court, Cornhill. (See page 76.)

Load-water-line.—The line of flotation when a vessel is properly laden or ballasted.

Load-water section.—The horizontal plane at the line of flotation.

Lob Sided.—Larger or heavier on one side than on the other.

Locker.—A small cabin, or cupboard, or cavity to stow articles in.

Log Line and Ship.—An ancient contrivance for testing the speed of a ship by throwing a line overboard with a piece of board called "the ship," at one end, and then by noting the time (usually done by a sand glass) it takes to run so much line out. Massey's or Walker's log are now constantly towed, but the log line and ship are regularly used on board large steamers.

Long Boat.—A ship's launch; usually carvel built.

Long Leg and a Short One.—In beating to windward, when a vessel can sail nearer her intended course on one tack than another. Thus, say her course is E. and the wind S. E. by E. she would lie E. by N. one tack, which would be the long leg, and S. by E. on the other, which would be the short leg.

Long Shore.—A contraction of along shore.

Long Tackle Blocks.—A double block with one sheave above the other, as a fiddle block, which see.

Look-out, The.—The men stationed on the bow, &c., to watch the approach of other ships or to seek the land, &c.

Lose her Way.—Said of a vessel when she loses motion or gradually comes to a stop.

Lose His Number at Mess.—(See Number.)

Lower.—To cause a thing to descend—as to "lower the topsail," &c. An order given to ease up halyards, as "lower," "lower away!"

Lower Masts.—The masts that are next the deck.

Lubber's Hole.—The opening in a masthead cap, by which seamen get to the top instead of by the futtock shrouds.

Lubber's Point.—The black line or stroke in the front part of a compass basin, by which the direction of a vessel's head is told. The lubber's point is always in a direct line with the vessel's keel, or stem and sternpost.

Lucky Puff.—A puff that "frees" a vessel in close hauled sailing.

Luff.—To come nearer the wind. To "spring your luff" is to luff all the ship is capable of, without making her sails shake.

Luff and Touch Her.—To bring the vessel so near the wind that the head sails begin to shake a little.

Luff of a Sail.—The weather cloth in a sail.

Luff Tackle.—A tackle composed of a single and double block, the standing part of the rope being fast to the single block.

Luff upon Luff.—One luff tackle hitched to the fall of another so as to make a double purchase.

Lugger.—A vessel rigged with lug sails like the fishing boats of this country and France.

Lug-Sail.—A sail set on a yard. (See "Dipping Lug.")

Lurch.—When a vessel is left unsupported at the bow, stern, or amidships, so that she makes a sudden dive forward, or by the stern, or a heavy weather or lee roll.

Lutings.—Stoppings of white lead, putty, tar, &c., for seams and joins in planks, &c.

Lying To.—The condition of a ship when hove to.

M.

Mackerel Sky.—A sky streaked with fine clouds, something in the manner of the stripes on the back of a mackerel.

Mackerel Tailed.—A boat with a very sharp or fine after body. "Cod's head and mackerel's tail" or "full forward and fine aft," once supposed to represent the solid of least resistance; now the order is reversed.

Made.—Built, as built mast, &c., meaning that the mast is not made of one piece of timber, but by several pieces bound together.

Main.—The open ocean. The principal, as main mast, main boom, main stay, main sail, &c.

Main Breadth.—The extreme breadth of a vessel.

Main Course.—The main sail of a square rigged ship.

Main Keel.—The keel proper, and not the keelson or false keel.

Mainsheet.—The rope or tackle which holds the aft clew of the mainsail. A good arrangement of mainsheet for a small boat with boom to the sail is to make fast one end of the sheet to one end of the after thwart, or near thereto (so that the sheet is clear of the helmsman) take the other end through a thimble eye in a strop round the boom and down through another thimble eye strop at the other end of the thwart; the hauling part can be made fast by a turn and bight above the latter thimble. This arrangement would do for a 10ft. or 12ft. boat, but in one of larger size a block should be stropped to the boom and thwart instead of the thimbles. (See "Belay.")

Mainsheet Horse.—A mainsheet horse is frequently used in small boats, and in America in large yachts as well. Less mainsheet is required on a wind when the lower block travels on a horse, and therefore the boom cannot lift so much and assist in throwing the sail in a bag. In a seaway, however, there is some advantage in having more drift between the blocks than would be very likely given if a horse were used. For small boats to obviate the shifting of the mainsheet from side to side in tacking the horse is of advantage. The foresheet can also be made to travel on a horse if the boat be decked or half decked.

Make Fast.—To securely belay a rope or join two ropes.

Make Ready There.—An order sometimes given to prepare to tack or lower a sail, as "Make ready for going about there," the "there" referring to the crew.

Make Sail.—To set sails. To add to sails already set. To shake out reefs.

Make Stern Way.—To drive astern as a vessel sometimes will in tacking by getting in irons or through the head sails being thrown aback.

Make the Land.—After losing sight of the land to approach and sight it.

Making Water.—Leaking. A vessel is said to make no water if she is so tight that none ever gets through her seams, &c., into the hold.

Man.—To apply manual power to anything, as "Man the capstan," "Man the boat," &c.

Man Overboard.—A shout of alarm made on board ship when a man gets overboard by accident. In such cases it is not usual to wait for orders, but everyone joins in if he sees he can be of service in throwing a lifebuoy, helping to launch a boat, jumping overboard, &c.

Man Ship.—An old-fashioned custom in the Navy of mustering the crew along the bulwarks to cheer upon parting company or meeting another ship. Losing yachts generally man the bulwarks and cheer a victorious yacht, a custom probably derived from the practice in "fighting days" of one war ship cheering another that was an enemy.

Marine Glue.—This composition is now usually employed to stop the seams of decks after they are caulked. The old fashioned plan was to use white lead putty for the stopping and indeed it is at this present time occasionally used; the objection to it is that it dries as hard as a cement and cracks, the result being that water gets into the caulking, rots it, and then leaky decks are the consequence. Moreover, hard putty is very difficult to get out of the seams without damaging the edges of the plank, and then in re-stopping ragged ugly seams are the result. Marine glue, on the other hand, if it does dry and crack can easily be renewed, and the edges of the plank remain uninjured.

To apply. In driving the oakum or cotton thread (the latter is sometimes preferred as it can be laid in finer strands, a matter of consideration, if the plank is closely laid) into the seams, the caulking iron should be dipped in naptha, and not in oil, as, if the sides of the plank are touched with the latter the glue will not adhere; naptha on the other hand dissolves the glue and assists in closely cementing the seams. The plank should be quite dry when the glue is applied, or it will not adhere to the sides of the seams. The glue should be dissolved in a pot, and applied by lip ladles used for paying, two being kept going; or the glue can be melted in the lip ladles. The glue should not be melted over too fierce a fire, as if it burns or ignites it will be spoilt. A little of the liquid glue can be usefully mixed with the other as it assists in keeping it dissolved. The glue that runs over the sides of the seams should be cleaned off with a broad sharp chisel and remelted. It is not advisable to scrape the surplus glue off the seams, as it cannot be so removed without leaving a ragged unsightly surface.

Mariner.—A sailor. Two hundred years ago it was spelt "maryner," and appears to have only been applied to men who were perfect as seamen. Thus, from a muster roll made in the seventeenth century, we find so many men set down as "maryners" and so many as "seafaring men."

Marks.—The pieces of leather, &c., on a lead-line (see "Lead.") In sounding it is usual to say, "By the mark," &c., if the depth of water accords to a mark; if there be no "mark," as between three and five fathoms, the leadsman says, "By the deep four," &c. (See "Lead.")

Marle.—To wind spun yarn round a rope to secure its parts, or round a hank of yarn to secure it.

Marline Spike.—An iron implement tapering to a sharp point used to open the strands of rope for splicing, to turn eye-bolts, &c.

Martingale.—A stay spread by a "dolphin striker" to help secure the jibboom, the same as a bobstay does the bowsprit.

Mast Carlines or Carlings.—Pieces of timber fitted fore and aft between the beams to support the mast.

Master.—The chief officer of a ship.

Master Mariner.—A master of a vessel who has a master's certificate of competency. An old-fashioned term. A "master mariner" is popularly known as a "captain" among yacht sailors, but a master is only a self-dubbed captain. Master is the correct term, and the only recognised one in law.

Masthead.—The part of a mast above the hounds. (See pages 90 and 94.)

Masthead Light.—The white light which steam vessels are required to exhibit at the masthead when under way. (See "Side Lights.")

Masthead Pendants.—The pendants and runners which help support the mast. (See page 90.)

Mast Hoops.—The hoops to which the luff of fore and aft sails are seized to keep the sail to the mast.

Mast Rope.—The heel rope by which a topmast is sent up and lowered; not, however, termed heel rope.

Match.—In competition as yachts in a race. Formerly all contests between yachts were termed matches. Of late years the term race has been more generally applied to such encounters.

Mate.—The officer next in command to the master.

Maul.—A heavy hammer used by shipwrights.

Meaking Iron.—An implement used to extract old caulking from seams.

Measurement.—Generally written admeasurement. The computation of a vessel's tonnage by certain rules. (See "Tonnage.")

Meet Her.—When a vessel begins to fly to or run off the wind, to stop her doing so by the helm. Generally to check a vessel's tendency to yaw by aid of the helm.

Meet, To.—To meet a vessel with the helm is after the helm has been put one way to alter her course to put it the other way to stop the course being altered any further. This is also called "checking with the helm."

Mess.—The number of officers or men who eat together. Disorder; entanglement.

Middle Body.—The middle third of a vessel's length.

Middle Watch.—The watch between midnight and 4 a.m. (See page 278.)

Mildew.—Sails if rolled up when they are damp frequently mildew, and it is almost impossible to get the stains out entirely. New sails suffer most in this respect, as the "dressing" not being entirely washed or worked out of them will ferment and cause the mildew. The stains can be partly removed by scrubbing the sail with fresh water and soap; then rub the sail with soap and sprinkle or rub whiting over it; leave the sail to dry and bleach in the sun, and repeat the process more than once if necessary. Both sides of the sail should be scrubbed. Astbury's white tanning composition is said to prevent mildew. Chloride of lime and other caustics and acids would remove mildew, but would almost certainly make the canvas rotten. If chloride of lime be used only, the clear liquor should be allowed to touch the sail, and the latter should be well rinsed in fresh water afterwards.

Mile.—(See "Knot.")

Missing Stays.—To fail in an attempt to tack. (See page 247.)

Mizenmast.—In a ship the after mast. So also in a yawl or ketch.

Mizen Staysail.—A sail set forward of the mizenmast on a stay in yawls.

Moment.—A weight or force multiplied by the length of the lever upon which it acts. Sail moment is the area of sails and the pressure of wind upon them multiplied by the distance the centre of effort is above the centre of lateral resistance, which represents the length lever. (See page 36.)

Momentum.—A force represented by a weight and the velocity with which it is moved.

Moon.—Sailors say there will be a moon at such and such a date, meaning that there will be a new moon or full moon, by which the time of high water is calculated.

Moor.—To anchor by two cables. (See page 264.)

Mooring Rings.—The rings by which the chain is attached to large stones used for moorings. Sometimes the bolts that hold these rings pass clean through the stone, and are secured underneath, but a more secure plan than this is that known as a "Lewis." In the engraving *a* is the ring or shackle, *b* a bolt with a screw nut and linch pin; *c c* movable parts of the bolt; *d* the key or wedge. When the key is in its place the cavities, if any, can be filled with lead or sulphur.

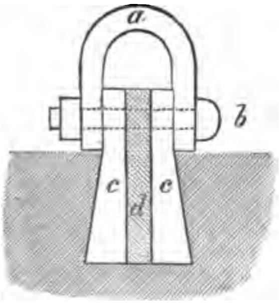


FIG. 114.

Morning Watch.—The watch from 4 a.m. to 8 a.m. (See page 279.)

Moulded.—The depth a timber is made between its curved surfaces as distinct from its siding, which is the thickness between its flat surfaces.

Moulded Breadth.—The greatest breadth of a vessel *without* the plank.

Moulds.—Curves used by draughtsmen. The skeleton frames made by shipwrights to cut the frames by.

Mourning Ribbon.—A blue ribbon run round a yacht's side, instead of a gold or white one, to denote mourning; also denoted by flying an ensign or burgee half-mast.

Mousings.—Yarns wound round hooks to prevent them becoming detached. Indiarubber rings were in use a few years ago as mousings for cliphooks, but are never met with now.

'Mudian Rig.—A contraction of "Bermudian."

Muslin.—A slang term given to the sails: generally applied to balloon sails.

Muzzler.—A wind that blows directly down a vessel's intended course. Synonymous with "nose ender."

N.

Nail-sick Clench-built Boat.—This is when the nail fastenings have become loose in a boat so that she leaks. Mr. J. C. Wilcocks recommends that the boat should have the whole of her ballast taken out; let her then be thoroughly cleaned out and laid on her sides, with sufficient weight to keep her so until the water begins to come over the gunwale. A man should be inside with some chalk or white paint, and mark every leak which becomes visible, first on one side, then on the other; or the boat can be hauled up and filled with water and marked outside. If the boat be decked, any recesses behind bulkheads or in the counter must be carefully examined, and marked in the same manner. After all the leaks have been discovered, let her be dried, and every nail examined; the lands or joinings of the planks should also be tried with the blade of a very thin knife. Any rivets which have worked very loose must be cut out, and replaced with nails and rooves of a larger size, and through the chief parts of the bottom it will probably be necessary to put an additional nail between every two originally driven. Many of the old nails which are only a little slack should again be hardened by a few taps on the inside, a boy holding on against the head of the nail on the outside. After this work has been thus gone through, melt a pound of pitch in a gallon of boiling Stockholm tar, and give her a good coat inside up to the level of the inside of the lockers—that is to say, as high as it can be done not to interfere with the paint. The garboard strake fastenings, and also those of the hood ends, must also be examined, and will be certain to require careful caulking. In tarring the boat inside, the ledges or lands should be quite filled up with the boiling stuff.

Neaped.—The situation of a vessel that gets ashore during high water at spring tides, and as the tides get shorter every day towards the neap tides she cannot be floated off till the next spring tides. Generally termed be-neaped.

Neap Tides.—The tides which occur between new and full moon; spring tides being at or near the new and full moon.

Near.—Very close to the wind, so that the sails shake or lift.

Near the Wind.—Close to wind; generally used in a sense to convey the meaning that the vessel is too near the wind, as "She's near forward," meaning that the head sails are shaking or lifting. (See "Nip.")

Nettles.—Small lines or ropes used to support hammocks when they are slung under the beams.

News.—The intimation conveyed sternly to the watch below to turn up when they do not obey the first summons, as "Do you hear the news there, sleepers?"

Niggling.—Sailing close to the wind or too close.

Nip.—A short bight in a rope, such as the part that goes round a sheave, &c. To nip a vessel is to sail her very close, or too close, to the wind.

Nippering.—Joining a rope by cross turns.

No Nearer.—An order given to a steersman not to luff any more, or not to bring the vessel, any closer to wind. When sailing free a course is frequently given to the steersman thus, W.S.W. and no nearer, or S.E. and no nearer, which may be varied "Nothing to windward of W.S.W.," or whatever the course may be.

Nosebag.—A name given to a jib, generally meaning a jib that is too big for the after sail.

Nose-ender.—Dead on end. A wind which blows directly down a vessel's intended course, involving a dead beat. (See "Muzzler.")

Noose.—A slip knot or running bight in a rope.

Number.—The number of a ship in the registry kept by the Registrar-General of Shipping; hence when a ship "makes her number" she hoists the signal flag denoting her number so that her name may be read. Also the number of a seaman on a ship's book. "To lose the number of the mess" is to fail to appear at mess through drowning or sudden death.

O.

Oars!—An order given to cease rowing and toss up the oars. (See "Lay in Oars;" and page 275.)

Off.—The opposite to near (which see), as "Off the wind." "Nothing off" is an order given to a helmsman to steer nothing to leeward of a particular course, or to sail nothing off the wind, but to keep the vessel full and bye. (See "No Nearer.")

Off and On.—Beating along a shore by a board off and then a board on.

Offing.—Away from the land, seaward. To make an offing is to sail away clear of the land.

"*Off She Goes!*"—The shout raised when a vessel begins to move at launching.

On.—In the direction of, as "on the bow," "on the beam," "on the quarter," "on for that buoy," &c.

On a Bowline.—Close-hauled. Generally applied to the square rig when a ship has her bowlines hauled taut to keep the leeches of the sails from shaking when she is close-hauled.

On End.—A mast is said to be on end when in its place; literally, standing on its end. Generally applied to topmasts.

On a Wind.—Close-hauled; not off the wind.

On an Easy Bowline.—Not quite close-hauled; a good full.

One, Two, Three, Haul!—A cry raised by the foremost hand in hauling on a tackle. All hands throw their whole weight and strength on the rope or fall at the word "Haul!"

Open.—Upon sailing round a point or headland when an object comes into view.

Opposite Tacks.—When of two vessels one is on the port tack and the other on starboard tack. Cross tacks.

Ordinary Seaman.—On board a man-of-war a young sailor not yet efficient in his duties so as to entitle him to the rank of A.B.

Outer and Inner Turns.—In bending a sail to a yard, the outer turns haul the sail out, the inner turns secure the sail.

Outhaul.—A rope or tackle by which a sail is hauled out on a spar, as distinct from an inhaul by which it is hauled inboard.

Outrigger.—A contrivance of some sort for extending a sail or stay outboard.

Over-canvassed.—Too much canvas.

Overfalls.—The rough water caused by the tide pouring over a rough or precipitous bottom.

Overhang.—The "knee of the head" or the curved piece of wood fitted to the stem to form a graceful or ornamental curve. Also the inclination the stem has outwards from the end of the water-line forward; also the overhanging part of the counter aft. Anything that projects beyond the base.

Overhaul.—To overtake another vessel; to loosen the parts of a tackle; to ease up, to slacken, or free the fall of a tackle; to slacken or "lighten up" a rope.

Overlap.—When *any part*, spars included, of one vessel covers or overlaps *any part* of another vessel. Generally when anything partly covers another thing.

Over-masted.—Masts that are too large or long for a vessel.

Over-rigged.—Generally more rigging, spars, and canvas than a vessel will properly bear.

Over-set.—To cause a capsize.

Overshoot a Mark.—To go up to a mark with too much way on so that the vessel shoots past it.

Over-reach.—To stand so long on a reach that upon tacking the vessel can fetch much farther to windward of a mark than was necessary or desirable.

Over-stand.—In beating to windward to stand on a reach so long that the yacht is able to clear a mark farther to windward than desired. (See "Over-reach.")

Overtake.—To approach a vessel that is sailing ahead. The "rule of the road" is that an overtaking vessel must keep clear of the vessel she overtakes; the vessel so overtaken must, however, keep her course steadily. In competitive yacht sailing this rule is somewhat different, as it allows the vessel that is overtaken to alter her course to windward to prevent the other passing her to windward; she must not, however, so alter her course to leeward.

P.

Paint.—(See "Black Paint.")

Painter.—A rope spliced to a ring bolt in the bow of a boat to make fast by. "To let go the painter" is figuratively to depart.

Palm.—The guard and thimble used by sail makers. Also the fluke of an anchor.

Paltry.—A wind is said to be paltry that is light and varies a great deal in direction; baffling.

Parbuckle.—To roll a spar, cask, &c., by placing it in the bight of a rope, one end of which is fast, the other hauled upon. (See page 265.)

Parcel.—To cover a rope with strips of canvas painted or otherwise. The canvas is wound round the rope and "served" with spun yarn.

Parrel or Parral.—Ropes or irons used to secure yards at the slings to the mast; rope parrels are commonly rove through balls of wood, so that they hoist easily on the mast. Parrels are used on the jaws of a gaff. An eye is usually spliced in either end of a parrel.

Partners.—A strong frame of timber fixed between the deck beams to receive and support the mast.

Pass—To reeve. Also to hand a thing one from another.

Passage—A voyage. To carry a person from one place to another is to give a passage.

Paul or Pawl.—An iron bar used to prevent the back recoil of the barrel of a windlass, &c.

Pay.—To run hot pitch and tar, or marine glue, &c., into seams after they are caulked.

Pay Off.—When a vessel's head goes off to leeward by virtue of the head sails being put aback or the helm being put up.

Pay Out—To veer or slack out chain or rope.

Peak.—The upper after corner of gaff sails, gaff topsails, lugsails, &c. A sail is said to have a great deal of peak when the gaff or yard makes a small angle with a vertical. A low peak means a flat headed sail.

Peak Downhaul.—(See pp. 91 and 110.)

Peak Halyards.—(See pp. 91 and 110.)

Peak Purchase.—(See pp. 91 and 110.)

Pendant.—A stout rope to which tackles are attached. (See pp. 90 and 97.)

Pennant.—A long white streamer with a St. George's cross at the hoist, used only by ships of the Royal Navy. It is said to owe its origin to the following incident: a Dutch Admiral hoisted a broom at his masthead as a symbol that he would sweep the English from the sea; the English Admiral retorted by hoisting a long streamer to denote that he would whip the Dutch off the sea; the English Admiral more nearly succeeded in his object than the Dutchman did. A Commodore has a broad pennant or swallow tail flag. (See "Burgee" and "Hoisting Pennant."

Peter.—(See "Blue Peter.")

Peter Boat.—A small fishing boat, sharp at both end, common at the mouth of the Thames and Medway.

Petticoat Trousers.—An ancient garment worn by sailors, now only used by fishermen; a kind of kilt.

Pig.—A heavy mass of iron or lead.

Pile Driving.—Pitching heavily and frequently in a short steep sea.

Pilot.—A person who takes charge of a ship in narrow or dangerous channels, and, who from his local knowledge of the same can, or ought to avoid the dangers of stranding.

Pintles.—The metal hooks by which rudders are attached to the braces.

Pipe.—To summons men to duty by a whistle from the boatswain's call.

Pitching.—The plunging motion of a vessel when she dives by the head; the opposite motion to 'scending, which is rising by the head and sinking by the stern.

Planking.—The outside skin of a vessel; plank laid on the frames or beams of a vessel whether inside or outside.

Plank Sheer.—The outside plank at the deck edge which covers in the timber heads, and shows the sheer of the vessel. The same as covering board.

Platform.—The floor of a cabin. (See "Deck.")

Points.—(See "Reef Points.")

Pole Mast—A long mast without a topmast, but with a long "pole" or piece above the hounds.

Poop.—The raised part of a vessel at her extreme after end. To be pooped is when running before the wind a sea breaks in over the stern.

Poor John.—Dried hake, a coarse fish caught on the west coast.

Port.—The left hand side, the opposite to starboard. Formerly termed larboard, which see. To port the helm is to put the tiller to port so that the vessel's head goes to starboard.

Portable Dinghies.—Numerous plans have been suggested for the construction of portable dinghies for small yachts, the best known perhaps being one adopted by Biffen, the well-known boat builder, in 1858. The boat was divided longitudinally into halves, each half being a complete boat, the longitudinal bulk heads coming as high as the thwarts; three iron clamps were fitted to one half of the keel, into which the other half of the keel was fitted. The top part of the bulkheads were kept together by thumb-screws inserted above the water line. The boat was 9ft. long, and 4ft. broad; in shape she did not differ from an ordinary dinghy when put together. She was used in a 6 tonner, and when not in use one half was stowed on either side of the cabin below. It was said that this boat could be put together in half a minute. In 1862 Biffen built a similar boat which was not so well recommended, on account of the multiplicity of fastenings. The obvious objection to such contrivances is of course the trouble of putting the parts together when the boat has to be used. (See "Berthon's Collapsible Boats.")

Ports and Portholes.—Square holes in the side of a ship for the guns, &c.

Port Sills.—The bottom framing of a port hole to which the lower half-port or shutter is hinged, also the frame to which the upper half-port is attached.

Preserving a Boat.—All small boats, if possible, should be hauled out of water or beached when not in use. Varnish preserves the wood from absorption better than paint. Whenever the varnish becomes worn, the boat should be re-coated.

Press of Sail.—All the sail a vessel dare carry.

Preventers.—Additional ropes, stays, tackles, &c., used to prevent spars being carried away if their proper stays give out, as preventer backstays for the topmast, (see page 90 and 101) preventer bobstay, &c. Any rope or lashing used to prevent something giving way.

Preventive Man.—An old fashioned name for a coastguard man, whose duty it is to prevent the landing of smuggled goods.

Protest.—A declaration that a yacht has not conformed to sailing rules.

Puff.—A gust of wind. A free puff is when it enables a vessel to luff; a foul puff when it breaks her off.

Punt Building.—The following directions for building a punt were given in the *Field* some time since:—Take for the sides two 1in. planks 16in. wide and 14ft. long; for the ends use 2in. plank. Cut the stern-piece 30in. long at bottom, and 40in. at top; cut the bow piece 12in. long at bottom, and 20in. at top; then cut a centre-piece 12in. wide, 40in. long at bottom, and 50in. long at top; put these pieces in position, and securely nail the sides to them; this can be readily done by bringing the planks into place by means of a rope, twisted by a short lever. After the sides are thus secured true up the bottom edges, and plank crosswise with three-quarter inch plank one-eighth of an inch apart; caulk these seams with oakum or cotton, and pitch the whole bottom, and 2in. or 3in. up the sides. A keel 1in., 2in., or 3in. deep can then be nailed on, depending on the depth of the water where the boat is to be used. For seats nail a plank across each end, and one for the rower over the middle piece; two rowlocks, about 6in. above the sides of the boat, complete the job. These can be made of plank, set up on end, and fastened to the inside of the boat. A common carpenter can make such a boat in about two days, and, if planed and painted, it looks well. The ends ought to incline outwards about 3in. to the foot. No. 1 shows the skiff completed, but with a stern piece adapted for steering with an oar; No. 5 is a diagram of the stern piece; No. 4 the bow piece; No. 2 the middle piece, and No. 3 the rowlock.

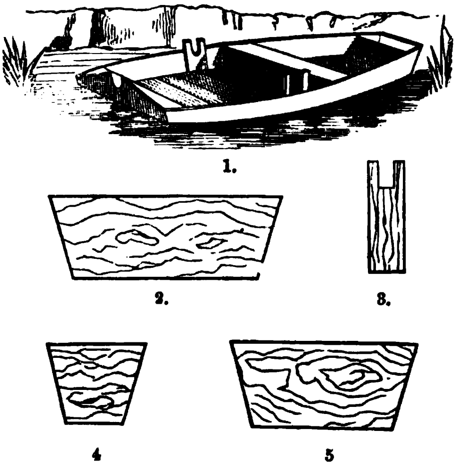


Fig. 115.

By putting in two pieces in the middle the required distance apart, and perforating the cross planking between them, a well would be readily formed.

Purchase.—A tackle, any contrivance for increasing mechanical power.

Put About.—To tack.

Put In.—To call at a port or harbour.

Put Off.—To leave, as to leave a ship's side or the shore.

Pykar.—An ancient English boat used for fishing.

Q.

Quarter Deck—The deck abaft the main mast, where the crew are never seen unless duty calls them there.

Quarter Fast.—A warp or rope made fast to the quarter; a quarter spring.

Quarter Master.—An officer who sees that the orders of the mate or master are properly executed, &c.

Quarter Timbers.—Large pieces of timber secured to the transom frame, which support the counter.

Quarter Watch.—When the two watches are subdivided into four watches, so that only one quarter of the crew is on deck at one time; sometimes observed in light weather.

Quarter Wind—The wind that blows on the quarter, or four or more points abaft the beam, but not dead aft. (See "Compass.")

Quarters.—That part of a yacht or ship nearest the stern.

R.

Rabbet or Rebate.—An angular channel or groove cut in the keel, stem, or sternpost, to receive the edges or ends of the plank.

Race—A competition between yachts. A strong current or tide running over a pit-like bottom producing overfalls. (See "Overfalls.")

Racking.—A rope or seizing used to lash the parts of a tackle together, so as to keep them from running through the blocks, whilst the fall is cast off for some purpose, or whilst one hand belays the fall. A lashing to prevent ropes rendering.

Rail.—The timber fitted on to heads of the bulwark stanchions. Called also "top rail."

Raising a Boat's Anchor.—(See "Anchor.")

Raising Iron.—A sort of chisel for removing the paying and caulking from seams.

Raising Tacks and Sheets.—To lift the clews of lower squaresails previous to tacking or wearing.

Rake.—To lean forward or aft from the vertical, as raking masts, raking sternposts, raking stem, &c.

Rakish.—A vessel that has a look of speed about her, probably originating from the fast schooners of former days that had raking masts.

Ramp.—In close hauled sailing, to sail a vessel along a heavy full without easing up the sheets.

Range.—Scope. To range is to arrange: to range the cable, to place a lot on deck ready for veering out.—To give a range of cable is to veer out enough in letting go the anchor to bring the vessel up without causing much strain to come on the bitts.—To sail near to, as to range up to windward, to range up alongside, to range along the coast, &c.

Rap Full.—The same as ramping full. By no means near the wind.

Rate of a Chronometer.—The daily loss or gain of a chronometer in relation to mean time.

Ratlines.—The small lines which cross the shrouds horizontally, and form the rungs of a ladder. Not generally used in yachts of 40 tons and under. To rattle down rigging is to fix to ratlines.

Reaching.—Sailing by the wind. A "reach" is the distance sailed between tacks, and means the same as board. To "reach" another vessel is to pass her. In reaching a schooner of 150 tons, say, will pass a cutter of 100 tons; that is, will "fore-reach" her, but the cutter holding a better wind will generally keep the weather gauge. A "reach" is a distance a yacht can sail from point to point without tacking, and often such a reach does not require the yacht to be quite close hauled. A reach is also the distance from bend to bend in a river or channel. (See "Head Reach," and "Fore Reach.")

Ready About!—The order given to prepare for tacking.

Ready, All.—Everybody make ready.

Rear Commodore.—The third flag officer of a yacht club, who has no duties in the presence of the Commodore or Vice-Commodore. He has two white balls in the upper corner of his pennant.

Rear Guard.—(See "After Guard.")

Recognised Yacht Club.—A term very frequently used in yacht rules; formerly it was a general condition that "a member of a Royal or recognised yacht club shall be on board" each yacht competing in a match, who is responsible for the due observance of the sailing rules. Often the rule required that a member of the particular club under whose auspices the match was being sailed should be on board. Of late years, since the establishment of the Yacht Racing Association, this rule has been modified to mean a member of a recognised yacht club. No one seems to know exactly what "recognised" means; strictly it should mean a club with an Admiralty warrant, but any "yacht club" is considered "recognised" which is organised for the promotion of properly conducted yacht matches. (See "Admiralty Warrant," "Royal Yacht Club," "Burgee," and "Ensign.")

Reef.—To shorten sail by reefing. Also to shorten a spar, as to take a reef in the bowsprit. The topmasts of some yachts are made with one reef in them. In such cases a thimble eye is seized to the backstays for the blocks of the falls to be hooked to when the reef is taken in. The depth of such a reef is usually about one-sixth the length of topmast from first fid to sheave hole. When the topmast is lowered to second fid it is called reefing, not housing.

Reef Band.—A strip of canvas sewn across the sail in which the eyelet holes are worked to receive the reef points. Not always met with in yacht sails.

Reef Cringles.—(See page 90.)

Reef Earing.—(See "Reef Pendant.")

Reef Knot.—(See Fig. 75, page 233.)

Reef Pendant (called also "reef earing").—A short and strong rope (with a Matthew Walker knot in one end) which is passed through the reef cringle of a fore-and-aft mainsail, and then through a sheave hole formed by the cheeks on the side of the boom end. One end of the pendant is passed up through a hole in the cheek on one side of the boom and stopped by the knot in the end. The other end is then passed through the reef cringle in the sail and down through the sheave hole on the other side of the boom. (See page 90.) Reef pendants are rove on opposite sides.

Reef Points.—Short pieces of rope attached to sails to secure the folds rolled up when reefing. (See page 90.)

Reef Tackle.—The tackle hooked to the reef pendants.

Register.—A certificate of ownership granted by the Registrar-General of Shipping.

Registry.—A register of all British ships kept by the Registrar-General of Shipping. When a ship is registered, the following documents must be produced: (1) Certificate of Custom House measuring officer. (2) Certificate of Board of Trade Surveyor; in the case of yachts this certificate is not required. (3) Builder's certificate, or if the builder's certificate cannot be obtained, a document setting forth all that is known of the vessel. (4) Declaration of ownership. All vessels, yachts, or otherwise of 15 tons N.M. and over must be registered. It is advisable to have even smaller vessels registered for the sake of holding the register, and being able to prove nationality when visiting foreign parts. The name of a vessel once registered cannot be altered except with the sanction of the Board of Trade. A quantity of useful information on the registry of ships will be found in a little book by Mr. Miles Stapylton, published by Oliver, St. Dunstan's Hill, E.C., and called the "Imperial Guide to Registry of British Shipping."

Render.—To slacken or ease up. A rope is said to render when it slackens without warning.

Reeve.—To put a rope through a hole of any kind.

Ribbands.—Long pieces of plank or timber, usually three sided, secured to the frames of a vessel in a fore-and-aft direction, when she is building, and representing the dividing lines or geodetic lines.

Ribs.—The frames or timbers of a ship or boat.

Ride.—To rest at anchor, or to be held by an anchor.

Ridge Ropes.—The ropes rove through the eyes of metal stanchions fitted in the top rail.

Riding Down.—When men go aloft and hang on the halyards and assist by their weight in hoisting sails.

Riding Light.—The white globular lantern hung on the forestay of vessels when riding at anchor.

Rig.—The arrangement of a vessel's spars, rigging, and sails, as schooner rig, cutter rig, lugger rig, &c. To rig is to fit the spars with rigging, &c. To rig out is to fit out.

Right Away.—In the direction of. A Yankee term for quickly, or move ahead.

Right Hand Rope.—Rope laid up or twisted with the sun.

Ring Bolt.—A bolt with an eye and a ring through the eye.

Ring Tail.—The studding sail of a gaff sail. (See page 241.)

Rings.—Rooves for bolt or nail clinching.

Rising Floor.—Distinct from flat floored, or flat bottomed; Sharp bottomed. (See "Dead Rise.")

Risings.—Stringers fitted inside small boats to strengthen them and support the thwarts. (See page 130.)

Roach.—The curved part of the foot of a sail.

Roadstead.—An open anchorage.

Rockered Keel.—A keel whose ends curve upwards thus . (See "Cambered.")

Rolling.—The transverse motions of a ship when amongst waves.

Rolling Hitch.—A way of fastening a rope to a spar.

Room and Space.—The distance from the centre of one frame to the centre of another.

Roove.—(See "Ruff.")

Rough-tree Rail.—The top rail fitted to the stanchions.

Round In.—To haul in on a rope.

Round To.—To bring by the wind. To come up head to wind. A vessel is said to "go round" when she goes about.

Round Turn.—To pass a rope twice round a pin or cleat so as to make a complete circle.

Rove.—The condition of a rope that has been passed through a sheave hole or through any aperture.

Rowlocks.—The fittings on the gunwale to receive the tholes or crutches for the oars.

Royal.—The sail next above the topgallant sail.

Royal Standard.—The flag of the Sovereign and Royal family. It is always flown at the main. When the Sovereign is on board, the standard is flown at the main, and the Admiralty flag (a white ground with red fouled anchor) at the fore, and white ensign (St. George's ensign) at the mizen.

Royal Yacht Club.—A club that has obtained permission from the Home Office to use the prefix "royal." An Admiralty warrant obtained from the Admiralty does not confer the title; but a royal yacht club that has not also the Admiralty warrant can only fly the red ensign, and this can have no device. A club with an Admiralty warrant takes precedence of a club that has only a Royal warrant. (See "Recognised Club.")

Rudder Trunk.—The trunk fitted in the counter to receive the rudder stock.

Ruff or Roove.—A small ring or square plate placed over copper nails before clinching in boat building.

Rules of the Road.—Certain rules framed under the provisions of the Merchant Shipping Act, 1854, to enable ships to better keep clear of each other. They are as follows:

Art. 11. If two sailing ships are meeting end on or nearly end on so as to involve risk of collision, the helms of both shall be put to port, so that each may pass on the port side of the other.

Art. 12. When two sailing ships are crossing so as to involve risk of collision, then, if they have the wind on different sides, the ship with the wind on the port side shall keep out of the way of the ship with the wind on the starboard side; except in the case in which the ship with the wind on the port side is close hauled and the other ship free, in which case the latter ship shall keep out of the way; but if they have the wind on the same side, or if one of them has the wind aft, the ship which is to windward shall keep out of the way of the ship which is to leeward.

Art. 13. If two ships under steam are meeting end on or nearly end on so as to involve risk of collision, the helms of both shall be put to port, so that each may pass on the port side of the other.

Art. 14. If two ships under steam are crossing so as to involve risk of collision, the ship which has the other on her own starboard side shall keep out of the way of the other.

Art. 15. If two ships, one of which is a sailing ship, and the other a steam ship, are proceeding in such directions as to involve risk of collision, the steam ship shall keep out of the way of the sailing ship.

Art. 16. Every steam ship, when approaching another ship so as to involve risk of collision, shall slacken her speed, or, if necessary, stop and reverse; and every steam ship shall, when in a fog, go at a moderate speed.

Art. 17. Every vessel overtaking any other vessel shall keep out of the way of the said last-mentioned vessel.

Art. 18. Where by the above rules one of two ships is to keep out of the way, the other shall keep her course, subject to the qualifications contained in the following article.

Art. 19. In obeying and construing these rules, due regard must be had to all dangers of navigation; and due regard must also be had to any special circumstances which may exist in any particular case rendering a departure from the above rules necessary in order to avoid immediate danger.

Art. 20. Nothing in these rules shall exonerate any ship, or the owner, or master, or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper look-out, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

Run.—The under part of a vessel aft defined by the buttock lines and water lines.

Run.—To sail before the wind. To come down by the run is to lower or overhaul without warning, or suddenly. To run away with a rope is to take hold of a fall and haul on it by running along the deck.

Run Down.—To foul a vessel or other object wrongfully or by accident.

Run Foul Of.—To get into collision with a vessel or other object.

Run Out.—To veer out a warp or cable.

Runners.—(See pages 90 and 105.)

Running Bowsprit.—A bowsprit that is fitted to run in and out like a cutter's. Since 1856 most schooners have their bowsprits fitted in this way.

Running by the Lee.—To run with the boom on one quarter when the wind is blowing on the other quarter. A dangerous proceeding. (See "By the Lee.")

Running Off her Helm.—Said of a vessel if, when sailing, her stern flies up to windward and giving her lee helm does not readily bring her to.

S.

Saddle.—A projection on a spar to support another spar, as the saddle on the mast for the jaws of the boom to rest upon.

Safety Cleats.—(See "Cruickshank's Cleats.")

Sagging.—Bending or curved downwards; the opposite of hogging. Sagging to leeward is to make a great deal of leeway.

Sail Her Along.—In close-hauled sailing, an order given to the helmsman when he is keeping the vessel too close to wind, meaning that he is to keep her a little off; sail her fuller or harder or "give her the whole weight of the wind," and keep her passing through the water as fast as possible.

Sail Her.—When lying to if way has to be got on again, the order is to "Sail her."

Sailing Directions.—Books of pilotage which accompany charts.

Sails.—Sails in this country are usually made of flax in the form of canvas. In America nothing but cotton canvas is used. Cotton stretches less than flax; but the objection to it is that in case of rain it takes up so much water as to become exceedingly heavy and so hard as to be almost unmanageable with the hands. Information on the cutting out and making of yacht and boat sails will be found in Kipping's treatise on "Sail Making," 2*s.* 6*d.*, Weale's Series.

St. Andrew's Flag.—A blue flag with white diagonal cross, thus ×

St. George's Jack.—A white square flag with red St. George's cross (right angled, thus +), used by admirals in the Royal Navy. This was the English flag before the union with Scotland and Ireland. (See "Jack.")

St. Patrick's Cross.—A red diagonal cross, ×

Salt and Fresh Water.—A cubic foot of salt water weighs 64lb.; a ton contains 35 cubic feet. A cubic foot of fresh water weighs 62·5lb.; a ton contains 36 cubic feet: hence salt water bulk for bulk will sustain a greater weight. When a vessel goes from salt water to fresh she is lightened in ballast, sometimes in order that she may present the same surface for friction. There will be a loss of stability, and on the whole the practice is of doubtful utility. Regarding the case inversely, if a vessel be loaded down in salt water to the same depth that she has been floating at in fresh water, and driven at the same speed, the resistance will increase in ratio to the superior density of salt water. No exact experiments have been made to ascertain whether a vessel, by floating somewhat lighter in salt than in fresh water, meets with a decrease of resistance. The comparison would be always attended with difficulty, as, if there were a difference in the resistance, it would be a very complicated matter unravelling it, as it would be necessary to know how much of the resistance depended on skin friction, and how much on wave making. We are inclined to think that the resistance (taking weight for weight) is a trifle less in salt water than in fresh. By removing weight the resistance in fresh water would be less, but the question of stability involved is such a serious matter that removing weight for river sailing cannot be advised. (See "Yacht Designing," page 93.)

Salute.—A salvo of cannon fired as a mark of respect and honour to a royal personage, commodore, vice or rear commodore, flag, &c. A Royal Salute is twenty-one guns. It is usual to salute a club flag officer on his first hoisting his flag (swallow-tail burgee) on a club station at the beginning of a season, and when he hauls it down at the end of a season, by eleven guns for a commodore, nine for a vice-commodore, and seven for a rear-commodore respectively. It is etiquette for a flag officer of a club to return a salute, but a royal personage does not do so. The practice used to be for a yacht to "salute the flag" on arriving at a station; this practice is still in vogue in America, a junior always saluting first. (See "Dipping the Ensign.")

Save All.—A water sail; a sail set underneath booms in light weather.

Scant.—When the wind is very bare; when the wind comes so that a vessel will barely lie her course.

Scantlings.—The dimensions of all kinds of timber used in the construction of a vessel.

Scarph or Scarf, or Scarve.—A method of joining pieces of wood by tapering their ends. A box scarph is when the ends are not tapered, but a half thickness cut out of each part so that when put together the parts form only one thickness.

Schooner.—A fore-and-aft rigged vessel. A topsail schooner has yards on her foremast, and sometimes on her mainmast, but no courses.

Scope.—Length or drift of rope or cable.

Score.—A groove to receive a rope or strop, &c.

Scowing an Anchor.—When small boats have to anchor on ground known or suspected to be foul, it will always be prudent to scow the anchor. Unbend the cable from the ring, and make the end fast round the crown, shank, and flukes with a clove hitch, and bring the end *a* back to *s*, and stop it with spun yarn or hitches; take the cable back to the shackle and stop it as at *b*; when the cable is hauled upon by the part *o* the stop will break, and the fluke of the anchor can be readily lifted out of its bed. Sometimes, instead of scowing the anchor a trip line is bent to the crown and buoyed. (See "Anchor.")

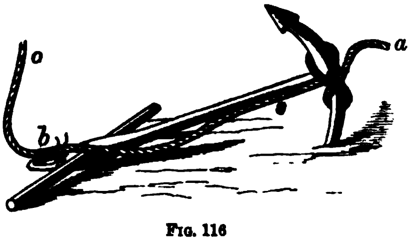


FIG. 116

Screens.—The wood shelves and screens painted red for port side, and green for starboard, in which a vessel's side lights are carried. (See Side lights.)

Scroll Head.—The outward curved part of the knee at the upper fore part of the stem, called volute.

Scud.—To run before a gale of wind with very little canvas set, or "under bare poles."

Scull.—An oar. To scull is to propel a boat by working an oar over the centre of the transom on the principle of the screw.

Scuppers.—Apertures cut in the bulwarks or waterways to clear the deck of water.

Sea, A.—A quantity of water, as, "she shipped a sea." A heavy sea is when the waves are large and steep.

Sea Boat.—A vessel fit to go to sea. A good sea boat is a relative term, and means a vessel that does not pitch badly or labour in a sea, or does not ship much water, and is, above all things, handy in a sea.

Seam.—The line formed by the meeting of two planks; overlapping parts of canvas in a sail.

Sea Pie.—A dish made up of all sorts in layers.

Sea Way.—Generally used in the sense of waves in an open sea, meaning a disturbed sea.

Seaworthy.—In every respect fit to go to sea. In chartering a ship it is insisted that she must be "tight, staunch and strong, and well equipped, manned with an adequate crew, provisions, &c."

Second Topsail.—A gaff topsail between the largest (the latter not being a ballooner) and the jib-headed topsail.

Selvagee Strop.—A strop made of spun yarn laid up in coils and marled.

Serve.—To cover a rope with spun yarn called "service."

Serving Mallet.—The mallet which riggers use to wind service round ropes and bind it up tightly together.

Set.—To hoist or make sail. This word is sometimes improperly confused with "sit" in reference to the way a sail stands.

Set Flying.—Not set on a stay or bent by a lacing; a jib in a cutter is set flying.

Set of the Tide.—Direction of the current.

Setting Up.—Purchasing up or hauling rigging taut.

Shackle.—A U-shaped crook with an eye in each end, through which a screw bolt is passed. Variously used, and are often preferred to hooks. There is a shackle at every fifteen fathoms of cable, so that by unshackling it the cable can be divided into many parts. Useful if the cable has to be slipped.

Shadow Sail.—This was a contrivance patented by Messrs. Harvey and Pryer, of Wivenhoe, in 1874, as an improvement on the spinnaker. It consisted of a gaff, goose-necked to the fore side of the masthead, and a boom to the fore side of the mast at deck. When the spars were in their places (the gaff being set up by halyards similar to the peak halyards of the mainsail), the sail was hoisted by its peak earing and throat, and hauled out by its clew to the boom end. Above the gaff a jib-headed topsail was hoisted. There were an after-brace for the gaff, an aft and a fore guy and topping lift for the boom. The sails were nearly of the dimensions of the main sails. (See Fig. 117.) Practically it was found that there was too much gear for the sail to be got out in a hurry, and in a strong wind the spars and gear would not have borne the strain of such large sails; and so the spinnaker remains in use. We believe Messrs. Harvey and Pryer's patent has only been fitted to one vessel, the Seabelle, and she only tried it once in a match.

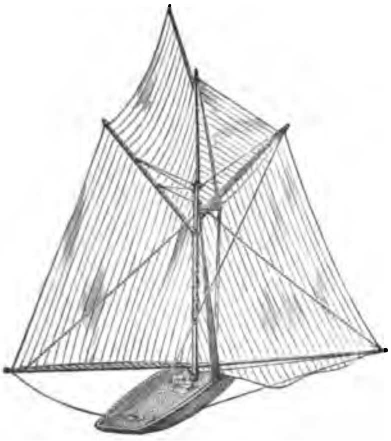


Fig. 117.

The plan appears to have been invented by Mr. N. M. Cummins, as that gentleman had a "shadow" fitted to his yacht Electra in 1869. Fig. 118 is a sketch of the Electra under the shadow or "cloud," as Mr. Cummins termed it.

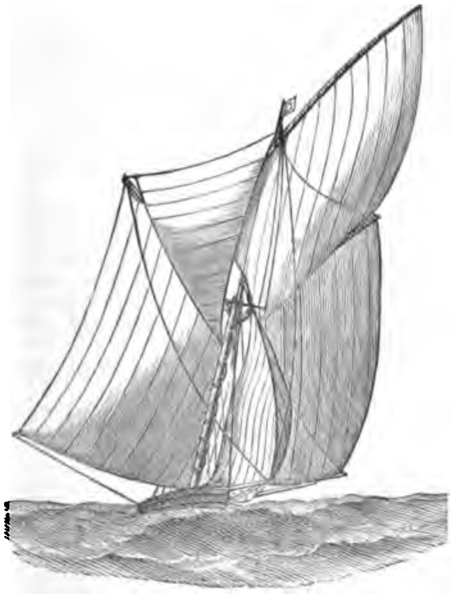


Fig. 118.

Shake, To.—To sail a vessel so close to wind that the weather cloths of the sails shake; the head sails generally are the first to shake, and if the helmsman does not notice it someone who does sings out, "All shaking forward;" or "Near forward."

Shake Out a Reef.—To untie the reef points and unroll a reef.

Shallow Bodied.—With a very limited depth of hold.

Shape a Course.—To steer a particular course.

Sharp Bottomed or Sharp Floored.—A vessel with V-shaped sections.

Sharp Bowed.—With a very fine entrance or a bow whose two sides form a very acute angle.

Sharp Sterned.—A stern shaped something like the fore end or bow, thus <.

Sheathing.—The copper sheets put on the bottom of a vessel.

Sheave.—The wheel within a block or in the sheave hole of a spar over which ropes pass.

Sheepshank.—A plan of shortening a rope by taking up a part and folding it into two loops or bights, and then putting a half hitch of each standing part over a bight.

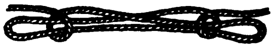


Fig. 119.

Sheer.—The fore-and-aft curve of a vessel's deck or bulwarks. To sheer is to put the rudder over when a vessel is at anchor, so as to cause her to move laterally and ride clear of her anchor. A vessel is said to break her sheer when she departs from the sheer that has been given her.

Sheer Hulk.—An old vessel fitted with sheers, whereby masts are lifted into other vessels. Sometimes used in the sense that nothing but the hulk remains.

Sheer Mast.—Two masts fitted in the form of a triangle, termed sheers. (See page 162.)

Sheer Plan or Sheer Draught.—A drawing showing a longitudinal vertical section or profile of a vessel. (See Plate III.)

Sheers.—Two spars erected in the form of a triangle (apex uppermost), to raise or lift heavy spars by.

Shelf.—A strong piece of timber running the whole length of the vessel inside the timber heads, binding the timbers together; the deck beams rest on and are fastened to the shelf. (See page 81.)

Sheet.—A rope or chain by which the lower after corners of sails are secured.

Sheet Home.—To strain or haul on a sheet until the foot of a sail is as straight or taut as it can be got. When the clew of a gaff topsail is hauled close out to the check block on the gaff. In square-rigged vessels a sail is said to be sheeted home when the after clews are hauled close out to the sheet blocks or sheave holes in the yard. This no doubt is the origin of the term.

Shifting Backstays.—The backstays that are only temporarily set up and shifted every time a vessel is put about or gybed. (See "Preventer.")

Shifting Ballast.—Ballast carried for shifting to windward to add to stiffness. A practice severely condemned in yacht racing. (See page 48.)

Shift her Berth.—When a vessel removes from an anchorage, &c.

Shift of Plank.—The distance one plank overlaps another.

Shift Ports.—To proceed from one port to another.

Shift Tacks.—To go from one tack to the other.

Shift the Helm.—To move the tiller from one side to the other; thus, if it is put to port, an order to shift the helm means put it to starboard.

Shift of Wind.—A change of wind.

Shin Up.—To climb up the shrouds by the hands and shins, when they are not rattled down.

Ship.—To put anything in position. To engage as one of the crew of a vessel. To ship a sea, to ship a crutch, to ship a seaman, &c.

Ship Shape.—Done in a proper and unimpeachable manner.

Ships' Papers.—These include builders' certificate, register (in case of not being an original owner, bill of sale as well), bill of lading, bill of health, &c. Also in the case of a yacht her Admiralty warrant.

Shiver.—To luff up and cause the sails to shiver or lift.

Shiver the Mizen.—To luff up until the mizen lifts or shivers.

Shoe or Shod.—Iron plates rivetted to the ends of wire rigging to receive shackle bolts.

Shore.—The land. A support of wood or iron, a prop.

Short Tacks or Short Boards.—Beating or working to windward by frequent tacking.

Shorten.—The wind is said to shorten when it comes more ahead. To shorten sail, to take in sail.

Shoot.—To move through the water after the means of propulsion is withdrawn.

Shy.—The wind is said to shy when it comes from ahead or breaks a vessel off.

Side Kelsons.—Stout pieces of timber fitted fore and aft on either side of the keel.

Side Lights.—The red (port) and green (starboard) lights carried by vessels when under way. Small yachts during bad weather are not required to have their side lights fixed, but must always have them ready on deck on their proper sides ready to show. Open boats must carry lights, and if the usual side lights are not used they must have lanterns fitted with green and red slides, to show when required. Steam yachts and steam launches, in addition to the *usual* side lights, must carry a white light at the masthead. Steam vessels when towing must carry two masthead lights one above the other. All vessels when at anchor are required to exhibit after sundown a white light at a height not exceeding 20ft. above the hull. This light must be visible one mile, and show all round the horizon. It is usual to put this light on the forestay. Pilot vessels carry a white masthead light, and exhibit a "flare up" every fifteen minutes. Fishing vessels when riding to nets carry a white light and show a flare up occasionally. If drift netting, a fishing boat must carry two white lights vertically. (See "Lights.")

Siding or Sided.—The size of a timber, &c., between its two-plane sides. (See "Moulding.")

Sight the Anchor.—To heave up the anchor.

Signal of Distress.—An ensign hoisted jack downwards.

Sit.—Sails are said to "sit" well when they do not girt, pucker, belly, or shake. This word is sometimes wrongly written "set."

Skeet.—An instrument (usually a horn on a stick) for wetting sails. In old yacht club rules skeeting to windward only was allowed, as it was thought the skeet might be used as a means of propulsion.

Skids.—Pieces of timber put under a boat's bottom for resting her on on launching.

Skiff.—A small boat used by coast watermen for the conveyance of passengers.

Skin.—The outside or inside planking of a vessel.

Skin Resistance.—The resistance a vessel meets with owing to the friction of the water on her plank or copper sheathing.

Skipper.—A slang term for the master of a yacht or other vessel.

Skysail.—A square sail set above the royals.

Sky Scraper.—A triangular sail set above the skysail. Sometimes the sail next above the skysail is a square sail; then it is termed a moonsail, and the sail above that a stargazer.

Slab Reef.—A kind of half-reef in a mainsail below the first reef, it takes up the foot or slab of the sail.

Slack.—Not taut. To slack up a rope or fall of a tackle is to ease it.

Slack Helm.—When a vessel carries very little if any weather helm.

Slack Tide.—The tide between the two streams when it runs neither one way nor the other. There is high-water slack, and low-water slack.

Slack in Stays.—Slow in coming head to wind, and still slower in paying off.

Slant of Wind.—A favouring wind. A wind that frees a vessel when close-hauled.

Sleep, or All Asleep—When the sails are full and do not flap or shiver.

Sliding Keel.—(See page 117.)

Slings.—Ropes or strops used to support or sling yards, &c.

Slip.—To let go, as to slip the cable.

Sloop.—A fore-and-aft rigged vessel something like a cutter, but usually has a standing bowsprit and only one head sail set on a stay. (See pp. 119, 171, and Plate XXII.)

Slot.—An aperture generally for a pin or bolt to travel in.

Smack.—A small trading vessel usually cutter rigged. A fishing cutter.

Small Helm.—Said of a vessel when she carries weather helm.

Snatch Block.—A block with an opening in the shell so that a rope can be put over the sheave without reeving it.

Sneak Boat.—A shallow and beamy boat in use on the Ohio and Mississippi.

Snotter.—An eye strop used to support the heel of a sprit. (See page 155.)

Snub.—To bring a vessel up suddenly when she has way on and only a short range of cable to veer out. Sometimes necessary if the vessel must be stopped at all costs, but a practice likely to break the fluke of an anchor if it is a good and quick holder.

Snug.—Comfortably canvassed to suit the weather. Anything made neat, or stowed compactly.

So !—An order to cease, often given instead of belay when men are hauling on a rope.

Soldiers' Wind.—A wind so that a vessel can lie her course all through to her destination without tacking or any display of seamanship.

Sounding.—(See "Lead.")

Soundings.—To be near enough to land for the deep sea lead to find a bottom.

Spales.—Cross shores used to keep the frame of a vessel in position whilst building.

Span.—A rope made fast by either end to a spar or stay, usually for the purpose of hooking a tackle to. (See page 111.)

Spanish Burton.—A purchase composed of three single blocks. A double Spanish Burton consists of one double and two single blocks.

Spanish Reef.—A knot tied in the head of a jib-headed sail.

Spanker.—The fore-and-aft sail set with boom and gaff on the mizen of a square-rigged ship; termed also the driver.

Span Shackle.—A bolt with a triangular shackle. The gammon iron that encircles the bowsprit at the stem. When it is directly over the stem the forestay is shackled to it.

Spars.—The masts, booms, gaffs, yards, bowsprit, &c., of a vessel.

Spars, Mensuration of.—Cubical contents of a spar can thus be found. Find the area of each end (see "Area of Circles);" add the areas of the circles together and halve the sum. Multiply the half by the length of the spar. If the spar tapers towards each end, the area of each end and the middle area should be taken, added together and divided by 3. Or, take the girth (see circumference "Areas of Circles") of the spar at each end and halve it. Find the square of the half, and multiply it by the length of the spar. If the spar tapers at both ends, find the girths at three places, halve and divide by 3; find the square of the quotient, and multiply it by the length of the spar. The weight of spars can be found by multiplying their solid contents by the weight in pounds of a cubic foot of the wood the spar is made of. Thus a cubic foot of red pine will weigh from 32 to 40lb., and a cubic foot of oak from 53 to 60lb.

Speed Indicators.—The log-line, log-ship, and sand-glass have done service to test the rate of speed for more than two hundred years; but they make at the best a clumsy contrivance, and it is not surprising that many attempts have been made to supersede it. Of these perhaps Massey's and Walker's logs are the best known, and, with certain limitations, the most reliable; but one objection to these has been that they do not show at a glance the rate of sailing, and, if anything fouls the log, the record of the distance sailed through the water is imperfect.* Another disadvantage—although, it must be confessed, it is a small one—is that, before the distance run can be ascertained, the log has to be hauled in. Some eight years ago we recollect witnessing some experiments in America with a fantail log attached to a small wire, which necessarily turned with the log. The wire was attached to some clock-like machinery on the poop, and a dial recorded the number of miles sailed. This instrument was said to have kept a true record of distances in a voyage to the West Indies and back; but, as it does not appear to have come into general use, it may be presumed that it was subject to mishaps. Reynolds's "pendent log" is similar to the American contrivance, inasmuch as it registers the miles run on board; but we have had no experience of its working.

The speed indicators which most resemble the line and log-ship in its results are those which only show the rate of sailing per hour, and do not record the distance traversed. Of these perhaps Berthon's log, or adaptation of it, is the most in favour, and if properly adjusted, marks very accurately the speed per hour at any moment. Berthon's log consists of a tube, which passes through the keel, or any immersed part of the hull, and, as the water will rise in this tube in accordance with the speed through the water, it was not a difficult matter to adjust a speed indicator in connection with the tube. Another kind of log, on the dynamic principle, is one invented by the late Mr. Joseph Maudslay. This was a very simple contrivance, and consisted of an ordinary Salter's spring balance, a line, and small weight.

The line was 25 fathoms long, and 1 inch in circumference. The lead weight was 6 inches long, 1½ inches in diameter, and weighed about 2¼lb. The ends of the lead were rounded off. A hole was made through the lead from end to end, through which the line was passed and secured by a knot. With 12 fathoms of this line and lead immersed the resistance at two knots per hour was found to be 1lb., and for other speeds the resistance increased nearly as the square of the speed; thus at two knots the resistance is 1lb.; at ten knots, or five times greater speed, the resistance is 25lb., as 5×5=25. We some years ago tested this log with Berthon's, and on different occasions on the measured mile, and found the speed pretty accurately indicated so long as the water was smooth; but when it came to rough water, the lead jumped about so that it was impossible to arrive at the exact speed.

The lead weight can be dispensed with; without it the line will not jump out of the water, and so a constant or steady pull can be obtained. We tried an experiment by towing a rope astern of a steam launch, and found the resistance at various speeds as set forth in the middle column. The rope forming the "log" was 13 fathoms long, the *whole* of which was permanently immersed. The rope was four stranded, "water-laid," and one inch and a quarter (1¼ inch) in circumference. A smaller line was spliced to the other as a tow line, as much of this being payed out as was sufficient to keep the larger rope immersed, or to prevent any part of the thirteen fathoms being towed out of water. At the splice, and on the larger piece of rope, was a piece of lead pipe about a foot long (with an inside diameter equal to the diameter of the rope). This served the double purpose of showing at a glance if the whole of the larger rope was not immersed, and helped to maintain the immersion. The after end of the larger rope should be whipped.

The log patented by Mr. Clark Russell is similar to this arrangement. On the face of the spring balance the numbers of the knots should be engraved opposite the resistance in pounds as set forth in the table.

Of course it must be understood that in all cases speed indicators or logs only show the speed through the water; and to calculate the distance made to the good over the ground the tide or current must be eliminated.

Knots.	Resistance of Proposed Log in lbs.	Resistance of Maudslay's Log in lbs.
2	1½	1
3	2¾	2½
4	4¾	4
5	7½	6½
6	11	9
7	15	12½
8	19½	16 2oz.
9	24¾	20½
10	30¾	25
11	37	30½
12	44	36
13	51½	42½
14	60	49
15	69	56½

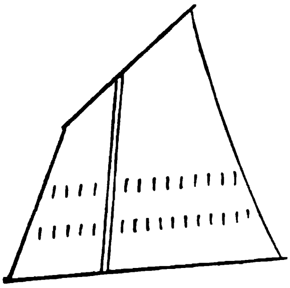


FIG. 119.

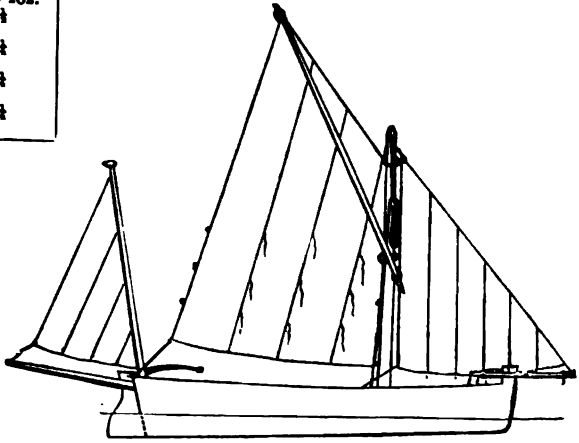


FIG. 120.

Spell.—The term of work allotted to any of the men in a watch. Thus there is the spell at the helm termed "trick;" spell at the masthead to look out, &c. (See "Trick.")

Spencer.—A fore-and-aft sail set with gaffs in square-rigged ships, as trysails on the fore and main mast.

Spider Hoop or Spider Band.—An iron band encircling the mast with iron belaying pins in it.

Spiling.—Marking on a bar of wood the distances that a curved line (say that of a frame) is from a straight line.

Spinnaker.—A jib-headed sail reaching from the topmast head to the deck, first introduced in yacht racing in 1865 by Mr. William Gordon in the Niobe, and hence for some time termed a "Niobe." The term "spinnaker" appears to have been applied to it as a kind of nickname, without "rhyme or reason."

Spindle Model.—A name given to a cylindrical model tapering at the ends.

Spirketting.—Timber worked inside a vessel under the shelf in a fore-and-aft direction.

Splice.—To join the ends of rope together by interweaving the untwisted strands. An eye splice is formed by interweaving the untwisted end of a rope in the lay of the strands.

Split Lug.—A lugsail in two parts (Fig. 119); the fore part is sheeted like a foresail, and in going about the tack is never cast off, nor is the tack of the after part of the sail.

Spoken.—Said when one ship has spoken to another by signal.

Spokes.—The bars of the wheel of a ship radiating from the boss. "To give her a spoke" is to move the wheel to the extent of the distance between spoke and spoke.

Sponson.—The platform ahead and abaft paddle wheels, usually outside the bulwarks, but sometimes inclosed.

Spoon Drift.—Spray blown from the crests of waves.

Spring.—A warp or hawser or rope.

Spring a Mast.—To crack or splinter a mast.

Spring her Luff.—To ease the weather tiller lines so that a vessel will luff to a free puff.

Sprit Sail.—A four-sided sail stretched by a pole termed a sprit. This is a time-honoured contrivance for setting a sail that has no boom, but a gaff is preferred if the sail has a boom. (See page 155.)

Sprung.—Damaged by cracking or splintering. (See "Spring a Mast.")

Spun Yarn.—Small rope or cord used for serving, &c.

Square.—Said of sails when they are trimmed at right angles to the keel. A ship is said to have square yards when there is little difference between the lengths of upper and lower, or when her yards are very long.

Square the Yards.—To brace them across at right angles to the keel. Square the boom is to haul it out at right angles to the keel.

Squeeze.—A vessel is said to be squeezed when she is sailed very close to the wind in order that she may weather some point or object.

Stains on Deck.—Iron moulds, &c., can be removed from a deck by a solution of one part muriatic acid, three parts water.

Stand.—A term variously employed; as to stand on the shore, to stand E.S.E., and so on, to stand on without tacking. A sail is said to stand when its does not lift or shake.

Standard.—(See "Royal Standard.")

Stand By. — The order to make ready; as "Stand by to lower the topsail."

Standing Part.—The part permanently made fast to something, and not hauled upon.

Standing Rigging.—The rigging that is kept permanently in its place. (See pages 91 and 97.)

Stand Up.—A vessel is said to stand up well that carries her canvas without heeling much.

Starboard.—The right hand side. The opposite to port.

Starbolins.—The men and "Watches" who compose the starboard watch. (See "Larbolins.")

Start, To.—To move, as to slacken a sheet or tack. To start a butt is to cause a plank to shift at its butt or end.

Started neither Tack nor Sheet.—Said when a vessel sails a long course without a shift of wind, so that there is no occasion for her to alter the trim of her sails.

Starved of Wind.—When a vessel is sailed so near the wind that she does not have enough of it, or feel the weight of it.

Stay, To.—To tack.

Stay Rope.—The luff or weather bolt rope of a jib or other sail.

Stays.—Ropes for supporting masts and other spars. A vessel is said to be in stays when she is going through the operation of tacking. To stay is to tack. (See "Missing Stays.")

Steady!—An order to put the helm amidships, or not to move it about.

Steerage.—In a yacht the space between the after athwartship bulkhead of the main cabin and the athwartship bulkhead of the after cabin. (The latter is generally known as the ladies' cabin.) Usually the term steerage is limited to the fore and aft passage and berths therein.

Steerage Way.—When a vessel moves through the water so that she can be steered. In simply drifting or moving with the tide a vessel has no steerage way on, and cannot be steered; therefore steerage way means that a vessel relatively to the water moves ahead and passes the water.

Steersman.—A helmsman.

Steeve.—The upward inclination or rake which a bowsprit has, or which the plank sheer has forward. The running bowsprit has usually a steeve corresponding with the sheer forward; a standing bowsprit has generally considerably more.

Stem.—The timber at the fore end of a vessel into which the ends of the plank are butted. To stem is to make headway, as against a current.

Stemson.—A piece of timber worked inside the stem.

Step.—A piece of timber or metal to receive a vessel's mast, &c. To step is to put a thing into its step.

Stern Board.—A movement of a vessel sternwards.

Sern Way.—Moving by the stern.

Stern Post.—The strong timber to which the rudder is hung.

Stern Sheets.—The seat in the aft end of a boat.

Stiff.—Not easily heeled; having great stability.

Stock of an Anchor.—The crossbar near the shackle.

Stocks.—The framework upon which a vessel rests whilst she is being built.

Stopper.—A rope or lashing used to prevent a rope or chain surging or slipping, as cable stopper, rigging stoppers, &c. The latter is usually a short piece of rope put on as a kind of racking to prevent the rigging or its tackles rendering. (See "Racking.")

Stops.—Yarns or short pieces of rope by which sails are secured when rolled up or stowed. Also the short lines by which sails are tied to yards when they are not laced.

Storm Sails.—The storm jib and storm trysail set in bad weather.

Stove in.—Broken in.

Stow.—To roll up. To pack away.

Straight of Breadth.—The distance where the breadth of a ship is equal amidships; now generally termed parallel length of middle body, because the two sides of a ship may be for some distance parallel to each other. A straight of breadth is seldom found in a yacht excepting in some long steam yachts; these frequently are of the same breadth for some distance amidships. (See "Body" and "Dead Flat.")

Strake.—A breadth of plank.

Strand.—Yarns twisted together and they then make the parts or strands of a rope.

Stranded.—Said of a rope when one or more of its strands have burst. Cast ashore.

Strands.—(See page 90 to 97.)

Stream.—The direction of the flood tide and ebb tide. The tides in the channel are usually referred to as the eastern stream for the flood and western stream for the ebb.

Stretch.—A course sailed.

Strike.—To lower. Also to strike the bottom, &c.

Stringers.—Strengthening strakes of plank or iron inside a vessel's frame.

Strop or Strap.—A sort of hoop made of rope yarn, wire, or iron, used to put round spars, rigging, &c., to hook tackles to.

Studding Sails.—Sails set outside the courses, topsail, &c., in square-rigged ships; called by sailors "stun sails."

Stuff.—Slang for sails, as, "Give her the stuff," meaning more sail.

Surge.—When a rope renders round a belaying pin, &c.

Swansea Pilot Boats.—A very snugly rigged kind of schooner met with in the Bristol channel. The rig comprises mainmast, foremast, and running bowsprit; the mainmast is stepped exactly in the middle of the boat, and has a great rake aft, so that the head of the mast plumbs over the after part of the cockpit, two sheaves are cut in it, through which the halyards are rove. The foremast is upright, with sheaves like the mainmast, and a block on the fore part under the sheave holes for the jib halyards. These masts require no rigging or stays, and are pole masts without any topmasts. The gaffs are short, being for a boat of 25 to 30 tons only about 6ft. long, and only require one halyard. The halyard is spliced to a single block, the other end being passed over the first sheave in the mast, then through a single block, which is hooked on to the gaff, and finally through the upper sheave. This end is belayed. A purchase is formed by a rope passed through the block on the halyard and through a block on deck. The fore halyards are rigged the same way, and the jib halyards are of the ordinary kind. The sails consist of mainsail, foresail, and jib; the two former being laced round the mast. These sails can be taken in in about one minute and a half, and set in about two and a half. The outhaul of the jib is passed under a sheave on the stem, and acts as a bobstay; there are no shrouds to bowsprit. The advantages of this rig are said to be that one man can handle a boat of 25 tons himself, and the boats are equally as handy with the foresail as without it, likewise the mainsail. They will stay or do anything either way, and with only the foresail and jib a boat can be sailed on a wind.

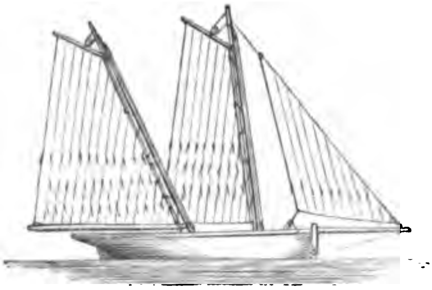


Fig. 121.

Swell.—Long waves with unbroken crests, usually met with after heavy winds have subsided.

Sweep.—A long bend. To sweep is to impel by sweeps or large oars; formerly, vessels as large as 300 tons used sweeps, and by hard work could make three knots an hour. Sweeps are not permitted in yacht racing.

Sweeps.—Large oars.

Swig, To.—The fall of a tackle is put under a cleat or pin, and is held firmly by one of the crew; another man then takes hold of the part of the fall between the cleat and the block and throws his whole weight on it; as he comes up the other hand takes in the slack. By swigging on a tackle a couple of hands can often get in all that is required, where by steady hauling they might not have moved the blocks an inch.—To drink.

Swivel Hook.—A hook that revolves by a pivot inserted in a socket and clinched.

T.

Tabernacle.—A strong trunk used in barges to step the mast in on deck so that the mast can be lowered for going under bridges. It is in fact a lengthening of the mast, the trunk being the housed part with a hinge or joint on deck. In small boats that have no deck the mast is generally stepped at the bottom of the tabernacle, and not on the top. (See page 150.)

Tabling.—The strengthening pieces of canvas sewn to the edges of sails where the roping goes on.

Tack.—The lower fore-corner of a sail. To tack is to go about or shift from one tack to another. The side on which the wind blows on the sails, as starboard tack or port tack. This term probably originated with the square rig, as "port tacks" aboard means that the lower port corners of the sail are now hauled in-board, whereas when the wind was on the other side these corners had been hauled outboard by the sheets.

Tackle.—An arrangement of ropes and pulleys for increasing power; a purchase. (Pronounced "tay-kle" by sailors.)

Tackle-fall.—The hauling part of the rope of a tackle.

Tack Tackles.—The tackles employed to set down the tacks of sails.

Taffrail.—The continuation of the top rail round the aft side of the counter.

Tail Block.—A block with a tail or piece of rope stropped to it for making fast the block instead of a hook.

Tail on.—An order to take hold of a rope and help haul.

Tail Tackle.—A watch tackle; that is, a double and single block. The single block has a hook; the double block a rope tail.

Take In or Take Off.—To hand or furl a sail.

Take Up.—To shrink; to tighten up.

Tanning a Sail.—No tanning will entirely prevent mildew, if the canvas is left unopened and unaired an unlimited time. For a 20ft. boat boil in a furnace of 15 gallons 28lb. of catechu, until thoroughly dissolved; put in such sails as convenient, and let them soak a night; then spread and mop them over both sides with the mixture. If required very dark indeed, double the amount of catechu. Sails too large for a furnace or vat are mopped only on a floor of asphalte, or cement with the mixture. Astbury's composition (Manchester) is said to prevent mildew, without discolouration of the canvas, but of this we have had no experience. Sails are sometimes "tanned" in a tan yard.

Taunt.—Tall, high, towering. (See "A-taunt.")

Taut.—Tight; stretched as tightly as possible.

Taut Bowline.—A ship is said to be on a taut bowline when the bowlines on the leeches of the sail are hauled as taut as possible for sailing near the wind.

Tend.—To attend to a sheet and watch it to see if it requires hauling in or slacking out; generally to attend to any work on board ship.

Tenon.—A sort of tongue cut at the end of a piece of timber to fit into a mortise.

Thimble.—A ring, pear shaped or circular, with a groove outside for ropes to fit in.

Thimble Eyes.—Eyes sliced in rigging round a thimble. A thimble seized in a strop. (See page 181, *e* Fig. 59.)

Tholes.—Pins fitted into the holes in rowlocks for oars to work in.

Thread.—A vessel is said to thread her way when she weaves in and out among other vessels, or through a narrow channel.

Throat.—The deepest part of the hollow of the jaws of a gaff, or the hollow of a V shaped knee, or the hollow of a floor. The throat halyards are those which are attached to the throat of a gaff. The upper weather corner of a gaff-sail is often called the throat, because it is attached to the throat of the gaff.

Through Bolt, or Through Fastening.—A bolt that passes through timber and plank.

Thumb Cleat.—Pieces of wood put on spars, &c., to prevent ropes or strops from slipping.

Thwarts.—The transverse seats in a boat. (*See* "Athwartships.")

Tidal Harbour.—A harbour that can only be entered on certain stages of the tide.

Tight.—Impervious to water; well caulked; not leaky. Never applied to the tension of ropes, &c., which are always "taut." (See "Taut.")

Tiller.—The piece of timber inserted in the rudder head for steering; usually termed the helm.

Tiller Lines.—The lines attached to the tiller to move it by. Generally in yachts of 40 tons and over, a tackle is used. In large yachts a second tackle is sometimes used, if the yacht carries much weather helm or is hard to steer: these second tackles are usually termed relieving tackles.

Timber-heads.—The heads or upper ends of the frames.

Timber Hitch.—A quick way of bending a rope to a spar. A loop or bight is formed by twisting the end of a rope round its standing part, thus:

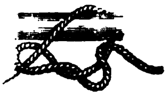


FIG. 122.

The end of the rope is shown on the right, and the standing part passing through the bight on the left.

Timbers.—The frames or ribs of a vessel.

Time Allowance.—The allowance made by one yacht to another in competitive sailing, proportional to the size of the yachts and the distance sailed. The Y.R.A. Scale founded on that of the Royal Alfred Club, which in turn was adapted from a scale prepared for the Royal Yacht Squadron, is the one in use in match sailing.—In small boat sailing, an allowance of 1sec. per inch for every excess inch of length for every mile sailed, is a good allowance. Where length and breadth are multiplied together, 1sec. per square foot for every mile makes a good allowance. Where length and breadth are added together, the allowance might be 1½ second per inch per mile. These allowances are only adapted for boats that do not differ much in length. Where the difference in length much exceeds a foot, the boats should be classed as a 20ft. class, 25ft. class, &c.

Timing.—In timing vessels *passing* marks to finish a race or otherwise, the fairest plan is to take the time as each vessel's stem reaches the mark. In timing yachts that have to gybe or tack round marks, time must be taken when in the opinion of the time keeper the yacht is fairly at or round the mark; this especially in the case of gybing.

Toggle.—A short rope with an eye at one end and a small piece of wood at the other, to insert in the eye and form a kind of strop or becket.

Ton.—A weight of 2240lb. avoirdupois. In hydraulics 35 cubic feet of sea water, represent a ton or 36ft. of fresh water. In the merchant navy 100 cubic feet of space represent a ton. In yacht tonnage the product of length, breadth, and half-breadth divided by 94 represents a ton.

Tonnage.—The nominal size or capacity of a ship, variously estimated. The tonnage of a merchant ship is her internal space or cubical contents expressed in 100 cubic feet to the ton, after making deductions for engine room and crew space. This is termed new measurement (N.M.) Builder's measurement (B.M.) or as it is sometimes termed old measurement (O.M.) is thus expressed.

$$\frac{(L - \frac{3}{5}B) \times \left(\frac{B^2}{2}\right)}{94}$$

where L is length, and B breadth.

According to builders' measurement, length is taken along the keel from the sternpost to a perpendicular or plumb line dropped from the stem-head on deck. By raking the sternpost the length of keel was shortened, and in order to prevent evasions in this way, the Royal London Yacht Club in 1854 passed a rule that the length should be taken on deck instead of along the keel. The tonnage of the vessels with very raking sternposts was, of course, much increased, and in order to let them off a little more easily, the whole beam was ordered to be subtracted from the length instead of ⅗ths of the beam. The rule then read

$$\frac{(\text{Length} - \text{Breadth}) \times \left(\frac{\text{Breadth}^2}{2}\right)}{94}$$

This is the rule once known as the "Thames Rule," and is the rule adopted by the Yacht Racing Association. The rule as applied by the Y.R.A. is thus formulated

$$\frac{(L - B) \times (B \times \frac{1}{2} B)}{94}$$

(Multiplying by beam, then by half beam, is the same as multiplying by the half square of the beam.)

The following is the Y.R.A. rule in text. The length shall be taken in a straight line at the deck, from the forepart of the stem to the after-part of the stern-post; from which, deducting the breadth, the remainder shall be esteemed the length to find the tonnage; the breadth shall be taken from outside to outside of the planking, in the broadest part of the yacht, and no allowance shall be made for wales, doubling planks, or mouldings of any kind: then multiplying the length by the breadth, and the product by half the breadth, and dividing the result by 94, the quotient shall be deemed the true tonnage; provided always that if any part of the stem or stern-post, or other part of the vessel at or below the load water-line project beyond the length taken as above-mentioned, such projection or projections shall, for the purposes of finding the tonnage, be added to the length taken as stated. In the case of a yacht whose stern-post has an elbow, the length shall be taken to a point where the stern-post, if its rake were continued, would cut the deck-line; and in measuring schooners or other yachts with overhanging stems, the length shall be taken to a point half the distance between the fore part of the stem at the deck line and a perpendicular to the true load water-line at its fore-end. Any fraction of a ton shall count as a ton. If, from any peculiarity in the construction of a yacht, or other cause, the measurer shall be of opinion that this rule does not measure a yacht fairly, he shall report the circumstances to the Council who may order the yacht to be measured as they may consider fair.

Tonnage for Competitive Sailing.—In 1874, Mr. D. Kemp proposed the following formula for estimating a yacht's value in competitive sailing.

$$\text{Tonnage power} = \frac{D \times M}{\sqrt[3]{D}}$$

Where D the displacement, and M the height, the metacentre is above the centre of buoyancy. The advantages of this rule are that a builder is left free to take any length, breadth, or depth he may choose, and it would fairly estimate the value of vessels of any type, generally the tendency of the rule would be towards increasing the displacement by depth, as the only means of reducing the estimate of a vessel's power would be by cutting down the metacentric height. This tendency would in turn be limited by the impossibility of getting a satisfactory vessel for competitive sailing with a very low centre of buoyancy. A suggestion has been made that the *exact* stability of a yacht should be used as the base of an estimate of her value in match sailing. The objection to this would be that her stability would vary with every alteration in the disposition or quantity of weight on board, and to the complicated nature of the calculation.

Another rule proposed by Mr. Kemp was thus formulated:—

$$A = \sqrt[3]{\left(\frac{L \times B \times D}{35}\right)}$$

$$P = L \times B.$$

$$\text{Tonnage} = \frac{A \times P}{122}$$

L length; B breadth; and D, mean depth from top of bulwarks to underside of keel. This rule would keep existing yachts at pretty much the same nominal tonnage as at present, and remove the penalty on beam to the extent of 30 per cent. A curious feature in this rule is that the cube root of the product of length, breadth, and depth, divided by thirty-five, equals pretty regularly the half beam of yachts which is the second multiplicand of the old Thames rule.

Top.—In square rigged ships, the stage at the lower mast heads to give additional spread to the topmast rigging, and to form a kind of gallery for riflemen in war ships. There are fore top, main top, and mizen top. To top is to raise one end of a boom or yard by the topping lifts. (See Plate I., and page 107.)

Top Gallant Bulwarks.—Bulwarks fitted above the top rail to afford additional shelter on deck.

Topgallant Mast.—The mast next above the topmast in square-rigged ships.

Top Hamper.—Any real or supposed unnecessary weight carried on deck or on the masts.

Topmast Hoops.—Occasionally hoops are used for jib-headed topsails. The hoops when not in use rest on the masthead. In hoisting the topsail the lacing is passed through an eyelet hole in the luff of the sail and through a hoop, and so on. When the sail is hoisted chock-a-block the lacing is hauled taut; in lowering the lacing is slackened. Hoops facilitate the hoisting and lowering of the sail, and admit of its being lowered with ease during a squall, and hoisted without a man going aloft.

Topping Lifts.—Ropes or tackles used to raise or support booms or yards. (See page 107, also Plate I.)

Top Rail.—The rail fitted on the stanchions as a finish to the bulwarks.

Topsails.—Racing yachts usually are supplied with various topsails, viz., balloon topsail, No. 1 topsail, No. 2 topsail, jib-headed topsail, and jib topsail. Formerly a square topsail was carried as well, but spinnakers have superseded these. A cruising yacht usually carries one square-headed topsail and one jib-headed topsail. American yachts usually carry one balloon topsail (called a club topsail—see Fig. 33, page 119) and one jib-headed topsail, called a working topsail, and a jib topsail. Schooners, both British and American, carry as well a main topmast staysail.

Topsail Schooner. — (See "Square Topsail Schooner.")

Topside.—That part of a vessel above the wales; now in yachts sometimes understood as the part between the water-line and deck, or the freeboard.

Top Timbers.—The upper parts of the framing of a vessel.

Top Your Boom and Sail Large.—To leave in a hurry.

Toss the Oars.—To throw them out of the rowlocks and rest them perpendicularly, blades uppermost.

Touching the Wind.—Luffing into the wind so that the sails shake. (See "Luff and Touch Her.")

Tow Rope or Tow Line.—The rope or hawser used in towing.

Track.—The course sailed by a ship. Her wake.

Trade Wind.—Winds that blow in one direction a considerable time, admitting of traders making expeditious voyages.

Trail Boards.—Carved boards formerly fitted on the bow and stem of schooners.

Transom.—The frame at the sternpost of a vessel. In boats the transverse board at the stern, which gives shape to the quarters and forms the stern end of the boat.

Transverse.—Athwartships. At right-angles to the line of the keel.

Trapezium.—A four-sided figure with two sides parallel, as a ship's square sail.

Trapezoid.—A four-sided figure whose sides do not form parallel lines, such as a cutter's mainsail.

Traveller. — An iron ring, thimble, or strop which travels on a spar, bar, or rope. (See page 90.)

Traveller, Jointed.—The fishermen on the S.W. coast use a jointed mast traveller. The iron hoop is in two half moons, each end has an eye turned in; the two halves are connected by these eyes. The object in having a jointed traveller is to facilitate lowering. (See page 223.)

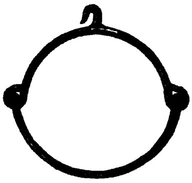


FIG. 123.

Trenails.—Bolts or plugs of wood used to fasten plank to the timbers of vessels. Originally spelt treenail. (See page 83.) Pronounced "trennel."

Trestle Trees.—In ships long pieces of timber fitted at the masthead in a fore-and-aft direction to support the cross trees.

Triatic Stay.—(See page 93 and 106.)

Trick.—The time a man is stationed at the helm. (See "Spell" and page 280.)

Trim.—The position of a ship in the water in a fore-and-aft direction. To trim a vessel is to set her in a particular position, by the head or stern. The term is sometimes erroneously used to represent the shifting of ballast transversely. To trim the sails is to sheet and tack them so that they are disposed in the best manner possible, in relation to the force of the wind.

Trip.—A passage. Sometimes used to denote a board made in beating to windward. To trip a spar is to cant it. To trip an anchor is to break it out of the ground; an anchor is a-trip when one of its flukes is on, but not in, the ground. (See "Anchor" and "Scowing.")

Trip or Tripping Line.—A rope used to cant a spar, as trip halyards for a topsail, or the line bent to the crown of an anchor to trip it or break it out of the ground.

Trough.—The hollow between wave-crest and wave-crest.

Trucks.—The wooden caps fitted on the upper mastheads to reeve the signal halyards through.

True Wind.—A wind that does not vary; the prevailing wind in contradistinction to eddies or baffling puffs.

Trying.—To "try" is when a vessel is hove to, if her sails are so trimmed that she may gather headway and make something to the good.

Trysail.—A small sort of gaff sail set in heavy weather. The sail set on the fore and main mast of square rigged ships similar to the spanker on the mizen. The meaning of trysail is probably that under it in heavy weather a vessel can try to sail.

Tuck.—The form of the hollow in the quarter by the transom or stern-post.

Tug.—A towing boat. To tug is to tow.

Tumble In or Tumble Home.—When the sides of a ship near the deck incline inwards, the opposite to flaring.

Tumbler.—A piece of wood pivoted in the jaws of a gaff which is always in the plane of the mast.

Tumbler-fid.—(See page 105 and 242.)

Turk's-head.—A knot made to finish off the end of a rope.

Turn.—A circle made by a rope round a pin, &c. "Turn O!" is an order to belay. To catch a turn is to put the fall of a tackle or part of any rope round a belaying pin, stanchion, &c.

Turn in.—To secure the end of a rope by seizing.

Turning to Windward.—Working or beating for a point or object by short boards. Generally beating to windward. To turn is to tack.

Turn of the Tide.—When the tide changes from flood to ebb, or the contrary.

Tween Decks.—Under a deck.

Twice Laid Rope.—Rope re-made from old rope.

Twiddling Stick.—The tiller, hence "twiddling lines" are the tiller lines.

Two-blocks.—Said when a tackle has been used so that its two blocks come close together. (See Chock-a-block.)

Tye.—A runner to which a tackle is hooked, used for hoisting lug-sails and squaresails.

Tyers.—Ropes or gaskets used to secure the mainsail of a fore-and-aft vessel when furled or stowed to the boom. The tyer that takes up the middle of the sail is termed the bunt tyer. (See "Gasket and Buntline.")

U.

Una Boat.—This is a centre-board boat with one sail introduced from America, where they are known as "cat boats." The mast is stepped close to the stem (sometimes with a rake aft), and the sail is laced to a boom and gaff. The name Una was given them because the first boat introduced at Cowes, from America, was so named. These boats vary from twice to three times their beam in length, and are very shallow. If handled with care, they are safe enough, very fast, and in smooth water very weatherly and handy. In squalls they should always be luffed up in good time, or they might be blown over. (See page 171.)

Unbend.—To cast loose a sail from its gaff, yard, &c. The opposite of bend.

Under Bowing the Sea.—When a vessel is close-hauled sailing in a cross sea, and gets the worst of it on the lee bow.

Under Canvas.—Proceeding by means of sail. With sail set.

Under Deck.—Below.

Under Hatches.—Below deck.

Under Run.—To follow up a rope, chain hawser, or cable, by hauling it in from a boat which moves in the direction that the cable, &c., is laid out.

Under Sail.—(*See* "Under Canvas.")

Under Shore.—Close to the shore or land.

Under the Lee.—Sheltered from the wind by the sails of another vessel. Under the lee of the land, sheltered from the full force of the wind by the land.

Under-way.—Moving through the water under the influence of the wind, steam, or oars. Sometimes wrongly written under-weigh. A vessel may be said to be under-weigh, when she is getting her anchor; but even then it would be the anchor, and not the vessel, that would be under-weigh.

Union Down.—An ensign with the jack downwards, hoisted as a signal of distress.

Union Jack.—A flag composed of St. George's, St. Andrew's, and St. Patrick's crosses. (See "Jack.")

Unmoored.—With anchors a-weigh. A vessel is also said to be "unmoored" when she is riding to a single anchor, as to be moored, two anchors must be down. (See page 265.)

Unreeve.—To haul out a rope from a hole, &c.

Unrig.—To dismantle a ship or any part of her, as to unrig a spinnaker boom, to unrig a bowsprit, &c.

Unship.—To remove a thing from its lodgment. The opposite of "to ship."

Up and down.—Vertically. The wind is sometimes said to be up and down the mast, when there is none at all, like Paddy's hurricane.

Upper Mast — Upper Stick. — A topmast, a topgallant mast, &c.

Upper Strake.—The top strake running round a vessel at the deck edge under the covering board, usually stouter than the general planking, and almost always of hard wood to better hold fastenings.

Usages of the Sea.—Customs of the sea in relation to commercial pursuits, which are held in law to be binding.

V.

Van.—The advanced part of a fleet.

Vane.—(*See* "Dog Vane.")

Vang.—A rope used to keep in the gaff of a schooner's foresail. The foresail of a schooner has usually very little peak, and consequently the halyards will not keep it from going off to leeward. A block is lashed to the mainmast head, through which the vang is rove and made fast to the fore gaff end; the fall of the rope leads to the deck. In square-rigged ships vangs are generally used on the spanker gaff. Sprit sail barges also use vangs.

Variation of the Compass.—The departure the compass needle shows from true North at certain parts of the globe. The difference between magnetic and true North usually expressed in degrees on charts. The variation widely differs, thus: in the English Channel it is about 23°, at New York only 5°. The deviation of the compass is due to local attraction. A chart called a "Variation Chart," shows by curved lines the changing variations of the compass needle for different parts of the globe. Variation must not be confused with the deviation due to local attraction in iron and composite ships.

Varnishing a bright Boat.—Oil the sides, and when the oil is dried in put on two coats of copal varnish. If size is used instead of oil, the varnish will peel off. To clean off varnish: take a mixture of soda (2lb.), soap (1lb.), boiled together, it will remove varnish from spars, &c. It should be applied hot.

Veer.—To pay out chain. Veer is also used in the sense of wearing or gybing. The wind is said to veer when it changes in direction with the sun; to back when it changes against the sun. On board a ship, the wind is said to veer when it draws more aft. To haul when it comes more ahead.

Veer and Haul.—To slacken up a rope, and then haul on it suddenly, in order that those who are hauling on it may acquire a momentum. Pulling by jerks.

Veer away the Cable.—The order to pay or slack out cable.

Veering a Buoy in a Vessel's Wake.—Throwing overboard a buoy in the wake of a ship when a man has fallen overboard, in the hope that he may get to it, and pick it up.

Vertical.—At right angles to the horizon, or perpendicular to the horizon.

Vessel.—A name for all kinds of craft, from a canoe to a three-decker.

Vice Commodore.—(*See* "Commodore.")

Victual. — To supply with provisions for a voyage, &c.

Voyage.—The passage of a vessel by sea. A short voyage is called a trip or a cast.

W.

Waist. — The middle part of a vessel 'tween decks.

Wake.—The peculiar eddying water that appears after a ship has passed. Vessels are said to leave a clean wake that do not cause waves to form astern.

Wales.—Thick strakes of plank.

Walk Away with It.—(*See* "Run Away.")

Wall Knot.—A knot formed at the end of a rope by unlaying the strands, and weaving them in and out.

Wall Sided.—Up and down sides of a vessel that neither tumble home nor flare out.

Wallow.—To lie in the trough of a sea and roll heavily; to roll under the sea.

Warrants.—(See "Admiralty Warrants.")

Wash Strake.—A movable strake of plank fitted to the gunwale of an open boat to increase her height out of water whilst sailing or otherwise.

Watch and Watch.—The arrangement whereby one half of the crew is on deck for four hours, then the other half for four hours. (See "Watches.")

Watch.—An anchor buoy or mooring buoy is said to watch when it keeps above water.

Watches.—The divisions of time for work on board a vessel. The crew of a ship is divided for this work into two watches, port and starboard, each watch being alternately on deck, excepting in emergencies, when both watches may be called on deck. Watches are thus divided: From 8 p.m. to midnight is the "First Watch." From midnight to 4 a.m. is the "Middle Watch." From 4 a.m. to 8 a.m. is the "Morning Watch." From 8 a.m. to noon is the "Fore-noon Watch." From noon to 4 p.m. the "Afternoon Watch." From 4 p.m. to 8 p.m. the two "Dog Watches." (See p. 278.)

Watching for a Smooth.—In a sea way looking out for a time when the waves are smaller to tack in, &c. (See page 245, 249, and 271.)

Watch Tackle.—A tackle consisting of single and double block; the single block has a hook, the double a tail.

Water Ballast.—Water carried in tanks or breakers as ballast. The tanks or breakers if intended to act as ballast should be kept full.

Water Borne.—Not resting on the ground, but being in the condition of floating.

Water Line.—A horizontal plane passing through a vessel longitudinally. A line shown in the half-breadth plan of a ship drawing. Length on load water-line means the length in a straight line from the fore side of the stem to the aft side of the stern-post at the water level.

Water Logged.—The condition of a vessel, that although her hold is full of water, she does not sink, owing to the buoyant nature of her cargo, or from other causes.

Waves.—The formation of waves is a subject which has received much attention of late, but no completely satisfactory theory as to their genesis has yet been evolved. The general theory is, that the smooth sea is acted upon by the impact and friction of the moving air or wind, and that the waves increase in size and speed, until the wind force is incapable of further developing them. Deep sea waves vary much in length, even under similar influences of wind pressure, and its continuation. Captain Motter of the French Navy, measured a wave in the North Atlantic, 2720ft., or half a mile from crest to crest, and Sir James Ross, one 1920ft. long. In the Bay of Biscay, where the sea is usually turbulent, waves have been seen of 1300ft. in length. Such waves however, are seldom met with, and Dr. Scoresby, who measured the lengths of some Atlantic storm waves he observed, had lengths of from 500ft. to 600ft. Measuring the heights of waves is a more difficult matter than measuring their lengths, and there has been much exaggeration under this head. The late Sir E. Belcher, at the Institute of Naval Architects in 1862, mentioned a wave he had observed rise to 100ft. Professor Rankine in his work on Naval Architecture, speaks of waves on rocky coasts rising to 150ft., and waves have been known to fly over the Eddystone Lighthouse. However, the greatest heights of deep sea waves as measured by Dr.

Scoresby, and other accurate observers, have been 48ft., but it is rare to meet with waves exceeding 30ft. in height. Ordinary storm waves such as met with in the Atlantic of about 200ft. in length, have a height of about one-twentieth of their length, but the ratio becomes lower as the length of the waves increase, and waves of 1000ft. in length have been observed with but a height of 10ft. On the other hand, waves of 600ft. in length have been observed of unusual steepness, and with heights one-eighth of their lengths. A long series of observations made by M. Bertin on the heights and lengths of waves, would seem to prove that the average height of deep sea waves is as 1 to 25 of their length. This of course is applied to single waves only. In what is termed a "confused sea," where a long wave may overtake and pass through a short one, the general height becomes increased, almost to the extent of the combined heights of both waves, and the wave form under such circumstances, is more or less "confused." In the English channel, superposed waves are common, and the waves generally being short and steep, heights are met with of about one eighth the length of the waves. (A wave length is the length from crest to crest, and wave height, the height from hollow to crest.)

The speed of waves are generally proportional to their length. Thus a wave 20ft. long, will travel 6 miles an hour, and one 50ft. long, 9 miles; 120ft., 15 miles; 200ft., 19 miles; 400ft., 27 miles; 600ft., 32 miles; 1000ft., 42 miles. It must be understood that it is only the *wave motion*, and not the water that travels, and no substance resting on the water is carried forward by the advance of waves further than the force of gravity may give a substance an alternate forward and backward motion, as it became differently situated on the sides of waves. Thus a ship will simply rise and fall with the waves and not be carried forward by them, and an unbroken wave would do a ship no harm in the sense of an impact due to the wave striking her. The danger from waves arises when they break over a ship, or when a ship by intercepting a wave causes it to break. (The best article in a popular form on Waves, and oscillations of ships among them is in Mr. W. H. White's "Manual of Naval Architecture.")

Ways.—Balks of timber arranged in a kind of shute to haul vessels upon or to launch them off.

Wear.—To bring the wind on the other side by putting the helm up so that the vessel's head goes round away from the wind instead of towards the wind as in tacking. (See "Gybe."

Weather.—The windward or "breezy" side of an object. The side on which the "weather" is felt; not to leeward. To weather is to pass on the windward side of an object. In cross tacking the vessel "weathers" another that crosses ahead of her. To weather on another vessel is to gain on her in a windward direction by holding a better wind than she does—to eat her out of the wind.

Weather Gauge.—The condition of a vessel that is to windward of another one. In slang, to possess an advantage.

Weather Helm.—The helm or tiller hauled to windward when a vessel owing to too much after sail has an inclination to fly up in the wind. If the centre of effort of the sails is much abaft the centre of lateral resistance, a vessel will require weather helm to keep her out of the wind. The tendency to fly up in the wind can be remedied by reducing the after sail, or setting more head sail, or by easing the main sheet. (The contrary to "Lee Helm," which see.) It has been frequently argued that the effect of the water pressure on the rudder when the helm is to windward, is to press the vessel bodily to windward, and no doubt there is some truth in this, although the influence of the rudder in this respect could be only small.

Weathering.—A relative term used in sailing to define the action of one vessel that is eating to windward of another, thus, if a vessel is said to be weathering on another she is eating her out of the wind, or closing up to her from the leeward, or departing from her in a windward direction.

Weather Lurch.—A weather roll or a roll to windward. In running with the main boom well off, it should be always secured with a guy, or it may fall to the opposite side during a weather roll, and cause some damage.

Weather Tide, or Weather-going Tide.—The tide that makes to windward or against the wind. (See "Lee-going tide.")

Wedges of Immersion and Emersion.—(See Immersed.

Wedging Up.—Lifting a vessel by driving wedges under her keel to take her weight off the building blocks before launching.

Weepings.—The exudations of damp or water through the seams or cracks of planks, &c.

Weigh.—To raise a thing, as weighing the anchor.

Well.—A sunken part of the deck aft, termed cockpit sometimes. In small vessels there is usually a well aft in which the steersman sits; the cabin of a small boat is usually entered from the well. The cabin of most American yachts, large or small, is usually entered from the cockpit aft.

Well That! Well There!—An order to cease hauling and belay.

Wexford Flat Bottom Boats.—These boats are built for the herring fishery, and are generally termed "cots." The fishing season lasts from about the middle of October to Christmas, and very often the boats are not put into the water for the rest of the year.

They are suitable to any coast without quays or shelter, and where there is often a heavy surf, making it necessary to haul boats above high-water mark every time they are used. Thus described in the *Field*:

The beam of the boat, that is of the larger sort, is about one fourth of its length, say 6ft. beam to 24ft. in length, built of the undermentioned woods, viz.: the bottom and the beams of either white or yellow pine, the strakes of yellow pine, and the stem and stern posts, and the timbers of elm grown in the country.

The accompanying sketch shows a boat turned over on its side exhibiting the bottom.

Fig 124.

The bottom boards are of wood, not less than an inch and a half thick; they are laid down on heavy pieces of squared wood, and the elm timbers, which are sawn out of wood having the necessary bend, so as to reach from a few inches beyond the centre of the bottom to the top of the gunwale, are about two inches square—they cross one another; the bottom boards are then pegged to these timbers by driving pegs three-quarters of an inch thick and some eight in length through the timbers and boards; the ends are left to be cut off after the boat has been finished and turned over. These pegs are secured by cutting out a wedge from the lower end with a chisel, and then driving the wedge into the place from which it has been cut, thus filling the peg-hole more tightly. No nails are used for the bottom except to attach the short piece of keel at the stern, say four feet; and the heads of these nails are sunk in the keel. These wooden pegs never move, and wear even with the bottom; breadth at bottom, 4½ft. The stem and stern are alike, no transom being required. The end of a short keel extends some two inches beyond the bottom of the sternpost to protect the rudder. The stem and stern posts are then morticed for the ends of the bottom boards, and, as it is well to have them strong, there is a good lot of dead wood.

The first strake is three-quarters of an inch thick, and often an inch; but before fastening this on the beam of wood under the centre of the boat is either removed or sunk in the ground, say, three inches, and heavy weights of stones usually are placed on the bottom, near the centre, to bend the bottom boards, as it is considered that they do not row or sail so well on quite an even bottom.

The rest of the strakes are half an inch thick, and fastened on both to the timbers and themselves with iron nails, galvanised if procurable. Twelve-pennies are used to fix to the bottom boards and timbers, and sixpenny nails to the strakes. Of course these boats are all clincher built, and are rather heavy, weighing three and a half or four hundredweight. They require four men generally to run them down and haul them up upon rollers. These are some 6in. in diameter if the sand is heavy. They place long boards or the sprits under the rollers.

The sails are usually two or three sprit sails (see sketch), and sometimes a foresail). No keel boats are ever used, owing to the great advantage of a flat bottom when they ground.

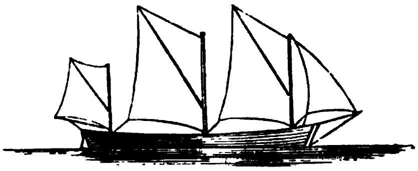


Fig. 125.

Accidents seldom take place with these boats, but, like all shallow boats, they require very skilful handling.

The centre-board now remains to be described. It runs in a frame or sheath formed for it in the centre of the boat These, when let down, draw about 3ft. below the bottom of the boat, and are about 2ft. broad. The board is about 1in. thick; no iron is used for them. When they near the shore they are hauled up. They are not required when the sails are not used. The depth of these boats is about 2ft. to the top of the gunwale, and they generally pull four oars. They are too broad for one man to scull. Of course they will not carry so much sail as a keeled boat, nor will they sail so near the wind.

The ballast used consists of large stones. The fishermen hereabouts are a bold and hardy race, and they need be, for herring fishing on a December night is desperately cold work; but it is their harvest of the sea, and when four men can take from twelve to twenty mace of herrings in the night (the mace is 500, and worth from 15s. to 20s.), it pays them well. It is a pretty sight to see forty or fifty boats out of a night; but it is very cold work, and none but those brought up to it could stand it.

Wheel.—Used to give motion to the rudder by chains which are attached to the tiller.

Where Away?—When an object is sighted, a question as to its bearing.

Wherry.—A small boat for rowing and sailing, usual rig a spritsail, main, and mizen, and foresail. (French "Houari.")

Whip.—A purchase consisting of one single block.

Whiskers.—(See pp. 93 and 94.)

Whistling for Wind.—In calms or light winds sailors sometimes amuse themselves by whistling in the hope that it will bring a breeze. They also scratch the boom for a breeze, or to make the vessel go faster. During heavy weather the superstition is all the other way, and no whistling or boom scratching is permitted.

Whole Sail Strength.—A wind of such strength so that a yacht can just carry all her canvas, including her "best" (not ballooner) gaff topsail, to windward.

Winch.—A drum with crank handles, pawl, &c., fitted to the mast to get in the topsail sheet, &c.

Wind Bound.—(See "Bound.")

Windfall.—An unexpected advantage or acquisition of treasure.

Windlass.—A horizontal barrel revolved by cranks or handspikes, used for getting the anchor. In yachts a small neat capstan is now generally used.

Winds.—Winds have been arranged according to the following table.

Velocity of wind in knots.	Pressure in lb. per sq. ft.	No. of force 0 to 12	Description of wind.	Sail Carried.
1.	·0067	1.	Light air	All balloon canvas.
2.	·027			
3.	·060			
4.	·107	2.	Light wind	„
5.	·167			
6.	·240	3.	Light breeze	„
7.	·327			
8.	·427	4.	Moderate breeze.	Whole sail, including first topsail.
9.	·540			
10.	·667	5.	Fresh breeze	Jib headed topsail.
11.	·807			
12.	·960			
13.	1·13			
14.	1·31			
15.	1·50	6.	Strong breeze	Lower sail.
16.	1·71			
17.	1·93			One reef.
18.	2·16			
19.	2·41			
20.	2·67			Two reefs.
22.	3·23	7.	Moderate gale	Three reefs, or close reefs.
24.	3·84			
26.	4·51	8.	Fresh gale	Trysail.
28.	5·23			
30.	6·00			
32.	6·83	9.	Strong gale	Reefed trysail.
34.	7·71			
36.	8·64			
38.	9·63	10.	Heavy gale	Storm trysail.
40.	10·7			
50.	16·7	11.	Storm	Whatever small sail could be got to hold together.
60.	24·0			
70.	32·7	12.	Hurricane	No canvas made strong enough to stand such a force.
80.	42·7			
90.	54·0			
100.	66·7			

Wing and Wing.—A schooner before the wind with the main sail off the lee quarter, and the foresail boomed out to windward. Sometimes termed goose winged. (See "Goose Wing.")

Wings of a Ship.—That part of a ship below water near the load line.

Wink.—A west country term for a kind of winch used in the bow of a boat by fishermen to raise the anchor. (See "Anchor.")

Wiring.—A stringer or ledge running fore and aft in a boat to support the thwarts. (See the table, page 213.)

Wisby Laws.—A code of maritime laws which, with the rules of Oleron, for many centuries formed the basis of all regulations relating to seamen and ships. Wisby is a seaport of Gothland in the Baltic, and a port famous so long back as the 13th century.

Woof.—The threads or texture of any kind of cloth or canvas, &c.

Work.—A vessel is said to work when the different parts of her frame, planking, &c., are not securely bound together so that the various parts relative to each other alter their positions.

Working to Windward.—Proceeding by short tacks. Beating to windward. To work up to a vessel is to get nearer to her or catch her whilst beating to windward.

Wrinkle.—Something worth knowing; a piece of valuable experience.

Wrinkles in copper are generally a sign of severe strains in vessels, or that the vessel "works," or that her frame and plank shifts when she is underway in a sea.

Y.

Yacht.—Generally any kind of vessel that is permanently fitted out and used by her owner for pleasure.

Yacht Club.—A club formed with the ostensible object of associating yacht owners, and promoting a fondness for the sea,

Yacht Racing Association.—An association of yachtsmen founded in 1875 in order to provide one code of sailing rules for use in all matches, and to decide such disputes as might be referred to the Council of the Association. The Association and Council are constituted similarly to the Jockey Club, and in no way trespass upon club privileges. The following are the Y.R.A. sailing rules, as sanctioned for 1878:—

1. *Management of Races.*—All races, and all yachts sailing therein, shall be under the direction of the flag officers or Sailing Committee of the club under whose auspices the races are being sailed. All matters shall be subject to their approval and control; and all doubts, questions, and disputes which may arise shall be subject to their decision. Their decisions shall be based upon these rules so far as they will apply, but as no rules can be devised capable of meeting every incident and accident of sailing, the Sailing Committee should keep in view the ordinary customs of the sea, and discourage all attempts to win a race by other means than fair sailing and superior speed and skill. The decisions of the Sailing Committee shall be final, unless they think fit, on the application of the parties interested, or otherwise, to refer the questions at issue for the decision of the Council of the Yacht Racing Association. No member of the Sailing Committee or Council shall take part in the decision upon any disputed question in which he is directly interested. The Sailing Committee, or any officer appointed to take charge for the day, shall award the prizes, subject to rule 30. If any yacht be disqualified, the next in order shall be awarded the prize.

2. *Postponement of Races.*—The Sailing Committee, or officer in charge for the day, shall have power to postpone any race, should unfavourable weather render such a course desirable.

3. *Measurement for Tonnage.*—The tonnage of every yacht entered to sail in a race shall be ascertained in the manner following: the length shall be taken in a straight line at the deck, from the fore-part of the stem to the after-part of the stern-post; from which deducting the breadth, the remainder shall be esteemed the length to find the tonnage; the breadth shall be taken from outside to outside of the planking, in the broadest part of the yacht, and no allowance shall be made for wales, doubling planks, or mouldings of any kind: then multiplying the length by the breadth, and the product by half the breadth, and dividing the result by 94, the quotient shall be deemed the true tonnage; provided always that if any part of the stem or stern-post, or other part of the vessel at or below the load water-line project beyond the length taken as above-mentioned, such projection or projections shall, for the purposes of finding the tonnage, be added to the length taken as stated. In the case of a yacht whose stern-post has an elbow, the length shall be taken to a point where the stern-post, if its rake were continued, would cut the deck-line; and in measuring schooners or other yachts with overhanging stems, the length shall be taken to a point half the distance between the fore part of the stem at the deck-line and a perpendicular to the true load water-line at its fore end. Any fraction of a ton shall count as a ton. [In the classes of 40 tons and under, a yacht built prior to 1877, shall be allowed to compete in the class for which she was designed, and without allowing time for any fraction of a ton in excess of such class, provided such fraction does not exceed $\frac{11}{100}$]. If, from any peculiarity in the construction of a yacht, or other cause, the measurer shall be of opinion that this rule will not measure the yacht fairly, he shall report the circumstances to the Council or Sailing Committee, who, after making such inquiries as they consider necessary, shall award a certificate of tonnage accordingly. The certificate of tonnage of the Yacht Racing Association shall be deemed a yacht's true racing tonnage, so long as she remains unaltered.

4. *Time allowance.*—Time shall be allowed on arrival for difference in tonnage, according to a scale, increased or decreased in proportion to the length of different courses.

If it is necessary during a race to shorten the course, the signal flag denoting the race hoisted under the white Peter, or in case of fog or darkness two guns fired shall show that the race is to finish with the round about to be completed, and the time allowance shall be reduced in proportion.

5. *Entries.*—Entries shall be made with the Secretary at least forty-eight hours previous to noon of the day appointed for starting each race. In case of a Sunday intervening, twenty-four hours shall be added. Entries may be made by telegram, and it shall be deemed sufficient that the same shall have been dispatched before noon of the day on which the entries close, subject to the provision as to Sundays.

Form of Entry.—Form of entry to be signed by the owner, or his representative, previous to the race:—

Please to enter the Yacht for the race at on the . Her distinguishing flag is ; her rig is ; and her tonnage, in accordance with Rule 3, is tons. I undertake that while sailing under this entry she shall not have on board *any bags of shot;* that all her ballast shall be properly stowed under the platform or in lockers, and shall not be *shifted or trimmed in any way whatsoever;* and that I will obey and be bound by the Sailing Rules of the Yacht Racing Association.

Signed this day of .

____

Should any yacht duly entered for a race not start, or having started should she give up, or be disabled during the race, such yacht shall, in the event of the race being resailed, be entitled to start; but no new entries shall be received under any circumstances whatsoever for a postponed race.

6. *Ownership.*—Each yacht entered for a race must be *bonâ fide* the property of the person or persons in whose name or names she is entered, who must be a member or members of a recognised yacht club.

7. *Ownership.*—No owner shall be allowed to enter more than one yacht in a race, except in cases in which a prize is given for each rig, when one yacht of each rig may be entered, nor shall he be entitled to enter the same yacht under different rigs for any race.

8. *One Yacht Entitled to Sail Over.*—When a prize has been offered for competition, any yacht, duly entered, may claim to sail over the course, and shall be entitled to the prize; subject, however, to Rule 2.

9. *Sliding Keels.*—No yacht which is fitted to shift keels, or to otherwise alter her form, shall be permitted to enter.

10. *Member on Board, and Declaration.*—Every yacht sailing in a race shall have on board a member of a recognised yacht club, who, before the prize is awarded, shall sign a declaration that the yacht under his charge has strictly conformed to all the sailing regulations, as follows:—

I hereby declare that the yacht whilst sailing in the race this day, has strictly observed the sailing rules and regulations.

(Signed)____________________

Date____________________

11. *Flags.*—Each yacht must carry, at her main topmast head, a rectangular distinguishing flag of a suitable size, which must not be hauled down unless she gives up the race. If the topmast be lowered on deck or carried away, the flag must be rehoisted in a conspicuous place as soon as possible.

12. *Instructions.*—Every yacht entered for

a race shall, at the time of entry, or as soon after as possible, be supplied with written or printed instructions as to the conditions of the race, the course to be sailed, marks, &c. Nothing shall be considered as a mark in the course unless specially named as such in these instructions.

13. *Sails.*—There shall be no restrictions as to sails, or the manner of setting and working them; but steam power must not be used for hoisting sails.

14. *Crew and Friends.*—There shall be no limit as to the number of paid hands, and no restrictions as to the number of friends, or to their working. No paid hand shall join or leave a yacht after the signal to start. [This rule is not intended to apply to Corinthian matches.]

15. *Fittings and Ballast.*—All yachts exceeding five tons shall be fitted below deck with the ordinary fittings of a yacht, including two transverse bulkheads of wood, and their platforms shall be kept down, and bulkheads standing. No water shall be started from or taken into the tanks after the signal to start has been made. No more than the usual anchors and chains shall be carried during a race, which must not be used as shifting ballast, or for altering the trim of the yacht. No bags of shot shall be on board, and all ballast shall be properly stowed under the platform or in lockers, and shall not be shifted or trimmed in any way whatsoever during a race. No ballast shall be shipped or unshipped after nine p.m. of the day previous to the race. A race resailed shall, so far as regards this rule, be considered a new race.

16. *Boats and Life Buoys.*—Every yacht exceeding thirty and under sixty tons, shall carry a boat on deck not less than ten feet in length and three feet six inches beam, and every yacht of seventy tons and over, one of not less than twelve feet in length, and three feet six inches beam, with oars lashed in them, ready for immediate use. Each yacht shall carry a life buoy on deck ready for use.

17. *Starting.*—The yachts shall start from moorings, anchors, or under way, as directed by the Sailing Committee. Half-an-hour before the time of starting one of the following flags of the Commercial Code shall be hoisted as a preparative flag for the yachts of each successive race; in case of a start from anchors or moorings to take up their stations for the start with headsails down, or all sails down, as the Sailing Committee may direct; or in case the start be a flying one, to approach the starting line, viz:—

B of Commercial Code for the Yachts of the	1st Race.
C	2nd „
D	3rd „
F	4th „

and so on.

Five minutes before the start the preparative flag shall be lowered and a blue peter hoisted, and a gun fired; after which, the yachts in the race shall be amenable to the rules. At the expiration of five minutes *exactly* the blue peter shall be hauled down and a second gun fired as a signal to start. If the start is to be made from anchors or moorings, lots shall be drawn for stations, and springs shall be allowed on the same bridle or anchor chain or warp as the bowfasts, but are not to be carried to a buoy, pier, other vessel, or fixed object. If any yacht lets go or parts her bridle before the signal to start, or if she drags any moorings or anchor to which she is made fast for the purpose of starting, she shall be liable to be disqualified, unless such parting or dragging be explained to the satisfaction of the Committee, or unless she has returned, after the signal to start, within the line of buoys, so as not to obtain any advantage by the accident. In a flying start if any yacht or any part of her hull or spars be on, or across the line before the signal to start is made, she must return and recross the line; a yacht so returning or one working into position from the wrong side of the line after the signal to start has been made, must keep clear of all competing yachts which are crossing, or have crossed the line properly. Should the gun miss fire, the lowering of the blue peter to be the signal to start.

18. *Meeting End On.*—If two yachts are meeting end on, or nearly end on, so as to involve risk of collision, the helms of both shall be put to port, so that each may pass on the port side of the other.

19. *Two Yachts Crossing, &c.*—When two yachts are crossing so as to involve risk of collision, then if they have the wind on different sides, the yacht with the wind on the port side shall keep out of the way of the yacht with the wind on the starboard side, except in the case in which the yacht with the wind on the port side is close hauled and the other yacht free, in which case the latter yacht shall keep out of the way; but if they have the wind on the same side, or if one of of them has the wind aft, then the yacht which is to windward shall keep out of the way of the yacht which is to leeward.

20. *Overtaking, Rounding Marks, &c.*—A yacht overtaking another yacht shall keep out of the way of the last mentioned yacht, but when rounding any buoy or vessel used to mark out the course, if two yachts are not clear of each other at the time the leading yacht is close to, and actually rounding the mark, the outside yacht must give the other room to pass clear of it, whether it be the lee or weather yacht which is in danger of fouling the mark. No yacht shall be considered clear of another yacht, unless so much ahead as to give a free choice to the other on which side she will pass. An overtaking yacht shall not, however, be justified in attempting to establish an overlap, and thus force a passage between the leading yacht and the mark after the latter yacht has altered her helm for the purpose of rounding.

21. *Obtructions to Sea Room.*—When passing

a pier, shoal, rock, vessel or other obstruction to sea room, should yachts not be clear of each other, the outside yacht or yachts must give room to the yacht in danger of fouling such obstruction, whether she be the weather or the leeward yacht; provided always that an overlap has been established before an obstruction is actually reached.

22. *Luffing and Bearing Away.*—A yacht may luff as she pleases to prevent another yacht passing to windward, but must never bear away out of her course to hinder the other passing to leeward—the lee side to be considered that on which the leading yacht of the two carries her main boom. The overtaking vessel, if to leeward, must not luff so as to interfere with the yacht she has overtaken until she has drawn clear ahead.

23. *Close-hauled Approaching Shore.*—If two yachts are standing towards a shore or shoal, or towards any buoy, boat, or vessel, and the yacht to leeward is likely to run aground, or foul of such buoy, boat, or vessel (a mark vessel excepted), and is not able to tack without coming into collision with the yacht to windward, the latter shall at once tack on being hailed to do so by the owner of the leeward yacht, or the person acting as his representative, who shall be bound to see that his own vessel tacks at the same time.

24. *Running Aground, &c.*—Any yacht running on shore, or foul of a buoy, vessel, or other obstruction, may use her own anchors, boats, warps, &c., to get off, but may not receive any assistance except from the crew of a vessel she has fouled. Any anchor, boat, or warp used must be taken on board again before she continues the race.

25. *Fouling Yachts, Marks, &c.* — Each yacht must go fairly round the course; and must not touch any buoy, boat, or vessel used to mark it out, but shall not be disqualified if wrongfully compelled to do so by another yacht. Any yacht causing a mark vessel to in any way shift her position to avoid being fouled by such yacht, shall be disqualified. If a yacht, in consequence of her neglect of any of these rules, shall foul another yacht, or compel other yachts to foul, she shall forfeit all claim to the prize, and shall pay all damages.

26. *Means of Propulsion.* — No towing, sweeping, poling, or pushing, or any mode of propulsion except sails, shall be allowed.

27. *Anchoring.* — A yacht may anchor during a race, but must weigh her anchor again, and not slip. No yacht shall during a race make fast to any buoy, stage, or pier, or send an anchor out in a boat, except for the purpose of rule 24.

28. *Sounding.*—No other means of sounding than the lead and line allowed.

29. *Side Lights.*—All yachts sailing in a race at night shall observe the Board of Trade rule as to the carrying of side lights.

30. *Man Overboard.*—In case of a man falling overboard from a competing yacht, all other yachts in a position to do so shall use their utmost endeavours to render assistance; and if it should appear that any yacht was thereby prevented winning the race, the committee shall have power to order it to be resailed between any yacht or yachts so prevented and the actual winner.

31. *Protests.*—Should the owner of any yacht, or the person acting as his representative, consider that he has a fair ground of complaint against another for foul sailing, or any violation of these rules, he must, if it arise during the race, signify the same on first passing the committee vessel, by showing an ensign conspicuously in the main rigging. The protest shall be made in writing, and under such regulations (if any) as the sailing committee may have determined, within twelve hours of the arrival of the protesting yacht, and shall be heard by the sailing committee and decided, after such inquiries as they may consider necessary. They shall also, without a protest, disqualify any yacht, should it come to their knowledge that she has committed a breach of the rules.

32. *Removal of Flag Boat.*—Should any flag vessel, buoy, or other mark boat be removed from its proper position, either by accident or design, the race shall be sailed over again, or not, at the option of the sailing committee.

33. *Penalty for Disobeying Rules.* — Any yacht disobeying or infringing any of these rules, which shall apply to all yachts whether sailing in the same or different races, shall be disqualified from receiving any prize she would otherwise have won, and her owner shall be liable for all damages arising.

Should a flagrant breach of these rules be proved against any yacht, her sailing master may be disqualified by the council for one season from sailing in any race held under the rules of the Yacht Racing Association.

34. *Cruising Trim.* — When yachts are ordered to sail in cruising trim, the following rules are to be strictly observed:—

1. No doers, tables, cabin skylights, or other cabin or deck fittings (davits excepted) shall be removed from their places before or during the race.
2. No sails or other gear shall be put into the main cabin in yachts exceeding forty tons.
3. Anchors and chains suitable to the size of the yacht shall be carried, one at the cathead (or in yachts of forty tons and under, at the usual place on the bow), which anchor shall not be unshackled from the chain before or during the race.
4. Every yacht exceeding thirty and under seventy tons, shall carry a boat on deck not less than ten feet in length and three feet six inches beam—a yacht of seventy tons and over, her usual cutter and dinghy.
5. No extra hands, except a pilot, beyond the regular crew of the yacht shall be allowed.

In the Appendix the Yacht Racing Association further recommend for the consideration of Sailing Committees:—

1. *Allowance to Schooners and Yawls.*—That as mixed races are no satisfactory test of the relative speed of yachts, the different rigs should, whenever practicable, be kept separate; but when mixed races are unavoidable, the following rule shall be observed:—

The tonnage of schooners and yawls to be reckoned for time allowance as follows, viz., schooners at three-fifths, and yawls at four-fifths of their actual tonnage; provided that in case of a yawl, her main boom when in its place and parallel to the deck, does not extend more than one-fifth her extreme beam abaft the aft side of her sternpost on deck. In calculating the deduction for difference of rig, the tonnage by certificate to the exact fraction to be used. The time allowances to be calculated from each vessel's reduced tonnage. Schooners and yawls shall not be allowed to enter in classes of forty tons and under at the reduced tonnage.

2. *Flying Starts.*—That flying starts should be adopted when practicable, but no time should be allowed for delay in starting.

3. *No Limit to Race.*—That any limit to the time for concluding a race should be avoided as far as possible.

4. *Classification.*—That the classification of yachts should, when possible, be as follows:—

Not exceeding .... 5 Tons.
Above 5 tons and not exceeding 10 „
„ 10 „ „ „ 15 „
„ 15 „ „ „ 20 „
„ 20 „ „ „ 40 „
„ 40 „ „ „ 80 „
„ 80 „

5. *Courses.*—That as distance is an important element in the calculation of time allowance, the marks and flag boats should be placed so as to mark as accurately as possible the length of the course, for which time is allowed.

6. *Rounding Marks.*—That in heavy weather it should be arranged, if practicable, for yachts to stay instead of gybe round marks.

7. *Room at Starting.*—Sailing Committees should be particularly careful to provide ample room between the points marking the starting line.

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Yard.—A spar used to extend a sail.

Yard Arm.—The extremities of yards.

Yarn.—A yarn is generally understood to mean one of the parts of a strand of a rope. The strands of old rope are separated and used as yarns for temporarily securing sails when rolled up, &c. A narrative, a tale, a long story, or discourse.

Yaw.—When a vessel's head flies from one direction to another; generally when a vessel does not steer a straight or steady course.

Yawl.—A cutter-rigged vessel with a mizen mast stepped in her counter.

Yellow Flag.—The quarantine or fever flag.

Yoke.—The lower cap on the masthead. It is cut out of solid wood, and either strengthened by an iron plate over the whole of its top, or an iron band round its entire edge. The cross trees are fitted on the yoke. (See page 93.) Also the crossbar put on the rudder-head of small boats, to which lines, termed yoke lines, are attached for steering.

Z.

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